

FBISE

BIOLOGY NOTES

Federal Board Islamabad
Presented by:

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STUDY GROUP

9TH
CLASS

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BIOLOGY NOTES FOR 9TH CLASS

UNIT-01

**INTRODUCTION TO
BIOLOGY**

CHAPTER WISE NOTES

Q1. How does science developed?

Ans: Development of science:

Of all the living organisms' human beings are the most intelligent ones. With their intelligence human beings started learning. With their learning, science developed.

Q2. State the term science?

Ans: Science:

In ancient times science meant knowledge or learning. Today we define science as the study of the world around us.

The study of science helps us to answer the how, what, where and why of our surrounding.

Q3. How would you define biology & relate it with its major Divisions?

Ans: Definition of Biology:

The word biology consists of two Greek words *bios* meaning life and *logos* meaning thought, reasoning and study. Biology is the study of living organisms.

Biology helps us to explain how living things relate to one another and to their surroundings.

Relation of Biology with its major divisions:

Biology has three main divisions:

I. **Botany:** Botany is the study of plants.

II. **Zoology:** Zoology is the study of animals.

III. **Microbiology:**

Microbiology (micro: tiny) is the study of micro-organisms e.g., viruses, bacteria etc.

Q4. Draw a table showing the branches of biology and the studies these deal with?

Ans: Some of the major branches of biology are:

Branches of biology	Studies deal with
Morphology	The study of the form and external structure of the organisms is called morphology.
Anatomy	The study of the internal structure of the organisms is called anatomy. Anatomy is also called internal morphology.

ختم نبوت ﷺ زندہ باد

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- ❖ ہمارے کسی بھی گروپ میں سیاسی و فرقہ واریت کی بحث کی قطعاً کوئی گنجائش نہیں ہے۔
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گروپ میں کسی بھی قادیانی، مرزائی، احمدی، گستاخ رسول، گستاخ امہات المؤمنین، گستاخ صحابہ و خلفائے راشدین حضرت ابو بکر

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جائے گا۔

نوٹ: ہمارے کسی گروپ کی کوئی فیس نہیں ہے۔ سب فی سبیل اللہ ہے

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Physiology	The study of the functions of various organs of the organisms is called physiology.
Histology	The microscopic study of tissues of organisms is called histology.
Cell Biology	The study of the structure and functions of the cell is called cell biology.
Genetics	The study of genes and heredity in organisms is called genetics.
Embryology	The study of the developmental stages of an organism from egg to the formation of a new organism is called embryology.
Palaeontology	The study of fossils is called palaeontology.
Taxonomy	The classification and naming of organism is called taxonomy.
Environmental Biology	The study of the interrelationship of organisms and their environment is called environmental biology. It is also known as ecology.
Socio-biology	The study of social behaviour of the insects/animals that make societies e.g., ants, honey bee is called socio-biology.
Parasitology	The study of parasites is known as parasitology.
Immunology	The ability of the body to protect itself from foreign substances and cells including infectious microbes is called immunity and the study of immunity is called immunology.
Entomology	The study of insects is called entomology.
Pharmacology	The science that deals with the study of drugs is called pharmacology.
Biotechnology	The study of use of different techniques to manipulate the living organisms for the benefit of mankind is called biotechnology.

Q5. State the term palaeontology?

Ans: Palaeontology:

The study of fossils is called palaeontology. Fossils are remains of the living things preserved by natural process. Fossils help the study of life in the past and process of evolution.

Q6. How does parasite and their host affect or influence one another?

Ans: The parasites derive its nutrients and shelter from the host, and does harm to its host.

Q7. What do you mean by hydroponics?

Ans: Hydroponics:

Plants are grown by using water culture technique. This technique for growing plants with their roots in a circulating water solution is called hydroponics.

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Q8. Explain the Quranic instructions which were hinted several hundred years ago to reveal the study of life.

Ans: Quranic instructions to reveal the study of life:

There are many verses in Quran which tell us about the origin of life.

i. Origin of Life in Water:

وَجَعَلْنَا مِنَ الْمَاءِ كُلَّ شَيْءٍ حَيٍّ

"We made every living thing from water." (Sura Ambia 21, Ayat-30)

As we know that living things consists of 85 to 90 percent of water. So all living things have come out of water and thus they have a common origin.

ii. Creation of Man:

خَلَقَ الْإِنْسَانَ مِنْ صَلْصَالٍ كَالْفَخَّارِ

"He made man from clay like the potter." (Sura Rehman, Ayat 14)

Creation of man consisted of two steps. The first step was the creation from water. The second step was to mix clay with water to create man. It can be said for all animals as man shares all characteristics of life with other animals.

iii. Reproduction:

فَمَخْلَقْنَا النُّطْفَةَ عَلَقَةً فَخَلَقْنَا الْعَلَقَةَ مُضْغَةً فَخَلَقْنَا الْمُضْغَةَ

عِظًا فَكَسَّوْنَا الْعِظَمَ لَحْمًا

"Then fashioned we the drop a clot, then fashioned we the clot a little lump, then fashioned we the little lump bones, then clotted the bones with flesh."

(Sura Al-mominoon, Ayat 14)

After creating life, Allah began the process of reproduction for the continuity of life.

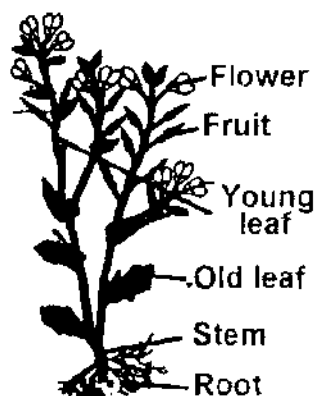
Q9. State the the main features of Mustard plant.

Ans: Mustard plant:

The botanical name of mustard plant is *Brassica campestris*. It can be divided into two parts on the basis of functions. Vegetative part consists of root, stem, branches and leaves, which do not take part in sexual reproduction. Reproductive part consists of flowers, which directly take part in sexual reproduction, forming seeds and fruits.

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Q10. State the the main features of Frog.

Ans: Frog:

The biological name of frog is *Rana tigrina*. It is an amphibian. The body of a frog consists of head, trunk, and limbs.



PRACTICAL WORK

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- **Identification of organs and organ system in a dissected frog (Dissected by the teacher)**

The following is the organ system of frog.

System	Organs
Digestive System	Oesophagus, Liver, Gallbladder, Pancreas, Stomach, Duodenum, Ileum, Rectum.
Respiratory System	Nostril, Buccal cavity, Lungs, Skin.
Circulatory System	Heart, Arteries, Veins, Capillaries, Blood, lymph.
Excretory System	Kidneys, Urinogenital duct, Urinary bladder, Cloaca.
Nervous System	Brain, Spinal cord, Nerves.

Materials required: Preserved frog, dissecting tray, dissecting kit.

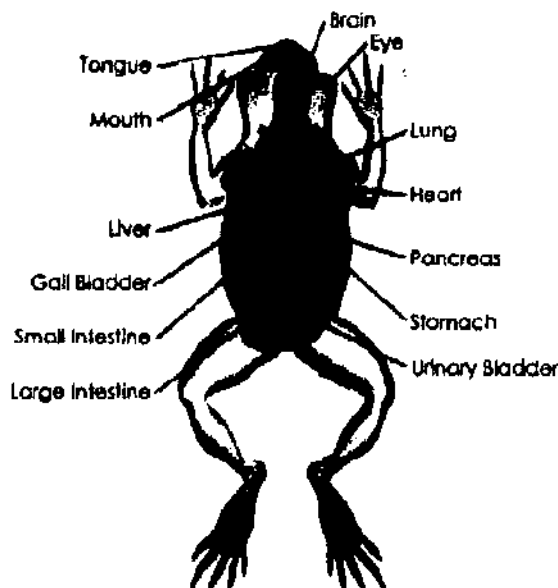
Procedure: The teacher will dissect an unconscious frog on a dissecting tray. First the teacher will demonstrate the various organ and organ system to the students then will ask the students to study in groups or individually.

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Use the above diagram to:

1. Locate and identify the organs of the digestive system.
2. Identify the parts of the circulatory and respiratory system that are in the chest cavity.
3. Use a probe and scissors to lift and remove the intestines and liver. Identify the parts of urinary and reproductive systems.
4. Remove the kidneys and look for threadlike spinal nerves that extend from the spinal cord.



Anatomy of a dissected frog

Observation: After identifying the organ and organ systems, draw the diagrams of your observation.

SUMMARY

1. Biology is the study of living organisms.
2. Biology has many divisions and branches. Biology is related to physics, chemistry, statistics, geography, psychology and economics.
3. Medicine, surgery, fisheries, agriculture, animal husbandry, biotechnology, horticulture and forestry are dependent directly or indirectly on the study of biology.
4. The Holy Quran instructs to reveal the study of life.
5. Muslim scientists have made great contributions in the field of biology, e.g. Jabir Bin Hayyan, Abdul Mālik Asmai and Bu Ali Sina etc.
6. Organisms are made up of small, simple, inorganic compounds as well as large, complex, carbon-containing organic compounds.
7. Four elements i.e., carbon, hydrogen, oxygen and nitrogen make up 96% of an organisms mass.

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8. The sixteen natural elements that are essential to life are called bioelements.
9. Molecules that are found only in living organisms are called biomolecules.
10. Levels of organization of life comprises of cell tissue, organ system and organisms.
11. The cellular organization of organisms are unicellular, multicellular and colonial.

EXERCISE

(MCQs)

- **Select the correct answer:**
- The study of functions of various organs of an organism is _____.
A. morphology B. histology
C. anatomy D. physiology
 - Histology is the microscopic study of _____.
A. tissues B. cells
C. fossils D. plants
 - Palaeontology is the study of _____.
A. environment B. development
C. fossils D. animals
 - The other name of environmental biology is _____.
A. ecology B. biotechnology
C. microbiology D. cell biology
 - Microbiology is the study of _____.
A. fungi B. animals
C. plants D. microorganism
 - Which Muslim scientist is known as founder of medicine?
A. Bu Ali Sina B. Abdul Malik Asmi
C. Jabir Bin Hayan D. Ibne-Nafees
 - Which one of these bio-elements is highest percentage in the human body?
A. Hydrogen B. Oxygen
C. Carbon D. Nitrogen
 - Which of the following contains unicellular organization?
A. mustard B. human C. euglena D. frog
 - Which of these major bio-elements is present in lowest percentage in human body?
A. oxygen B. phosphorous
C. calcium D. nitrogen

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- 10. If a scientist is studying the methods of inserting human insulin gene in bacteria, which branch of biology may this be?**

A. anatomy
B. physiology
C. biotechnology
D. pharmacy

ANSWERS:

1. D	2. A	3. C	4. A	5. D
6. A	7. B	8. C	9. B	10. C

SHORT QUESTIONS

- Q1. Why are the following scientists famous for?**
- | | |
|---------------------|----------------------|
| a. Jabir Bin Hayyan | b. Abdul Malik Asmai |
| c. Bu Ali Sina | |

Ans: Contribution of Muslim scientists:

- a. Jabir Bin Hayyan:**

Jabir Bin Hayyan introduced experimental investigation in chemistry. He wrote number of books on plants and animals. His famous books are "*Al-Nabatat*" and "*Al- Haywan*".

- b. **Abdul Malik Asmai:**

Al-Asmai is considered as the first Muslim scientist who contributed to Zoology, Botany and Animal husbandry. His famous book is "*Kitab Khalaq-al-Insan*".

- c. Bu Ali Sina:

Bu Ali Sina is known as the founder of medicine. He was a physician, philosopher, scientist, astronomer and a poet. His famous books are *"The Book of Healing"* and *"The Canon of Medicine"*.

- ## 02. Can you distinguish between?

- (a) **Anatomy and Morphology**
- (b) **Micromolecules and Macromolecules**
- (c) **Biotechnology and Immunology**
- (d) **Genetics and Socio-biology**
- (e) **Organ and Organelles.**

Ans: (a) Differences between Anatomy and Morphology:

Anatomy	Morphology
i. The study of the internal structure of the organisms is called anatomy. Anatomy is also called internal morphology.	i. The study of the form and external structure of the organisms is called morphology.
ii. Anatomy studies the presence of structures.	ii. Morphology studies the relationships of structures.

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iii. Anatomy is a subdivision of morphology.

iii. Morphology is a branch of biology.

(b) Differences between Micromolecules and Macromolecules:

Micromolecules	Macromolecules
i. A molecule having low molecular weight is called micro molecule.	i. Molecule having high molecular weight is called macromolecule.
ii. "micromolecules" is only used in biochemistry to indicate fatty acids, amino acids, proteins of low molecular weight.	ii. Macromolecules are defined as molecules being composed by about 1000 atoms. These might be either organic molecules (proteins, DNA, etc.) or natural/synthetic polymers.

(c) Differences between Biotechnology and Immunology:

Biotechnology	Immunology
i. The study of use of different techniques to manipulate the living organisms for the benefit of mankind is called biotechnology.	i. The ability of the body to protect itself from foreign substances and cells including infectious microbes is called immunity and the study of immunity is called immunology.
ii. The most prominent area of biotechnology is the production of therapeutic proteins and other drugs through genetic engineering.	ii. There are two types of immunity: active and passive.

(d) Differences between Genetics and Socio-biology:

Genetics	Socio-biology
i. The study of genes, and heredity in organisms is called genetics.	i. The study of social behaviour of the insects/animals that make societies e.g. ants, honey bee is called socio-biology.
ii. Genetics is the study of inheritance. Genetics forms one of the central pillars of biology and overlaps with many other areas, such as agriculture, medicine, and biotechnology.	ii. The branch that deals with the study of social behaviour of the animals that live in societies.

(e) Differences between Organ and Organelles:

Organs	Organelles
i. Group of tissues doing a particular job e.g. the heart.	i. Microscopic structure which does a particular job in a cell, e.g. the nucleus.
ii. Organs are part of the body.	ii. Organelles are part of the cells.

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iii. Found in multicellular organisms.	iii. Found in all life -- unicellular or multicellular.
iv. Organs collectively form organ systems.	iv. Organelles contribute to form a cell.
v. Performs specific life process in the body	v. Performs a specific process within the cell.
vi. They are macroscopic in structure.	vi. They are microscopic in structure.
vii. Brain, Heart, Lungs, are a few examples of organs	vii. Mitochondria, Nucleus, Golgi apparatus are a few examples of organelles

Q3. How biology is linked with other sciences?

Ans: Relationship of biology with other sciences:

- Biology in one way or other is integrated with other disciplines of science. Biology includes information on various aspects of living things but these information relate to the other branches of science as well.

The animals move, walk or run on the principles of physics. There is a similarity between working principle of lever in physics and human limbs.

The behaviour of atoms and molecules underline and explain the behaviour of living cell. The physical structure of atoms and molecules determine their chemical properties and the roles they play in cells.

To understand biology, basic knowledge of chemistry is necessary. *The biology is not an isolated science. It is associated with other branches of science.* This forms the basis of interdisciplinary sciences.

Q4. How colonial organisms are different from multicellular organisms?

Ans: The difference between a multicellular organism and a colonial organism is that individual one-celled organisms from a colony can, if separated, survive on their own, while cells from a multicellular life-form (e.g., cells from a brain) cannot

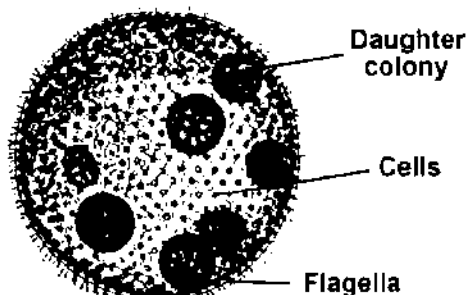
Multicellular organisms arise in various ways for example by cell division or by aggregation of many single cells. Colonial organisms are the result of many identical individuals joining together to form a colony. Algae of the genus Volvox are an example of the border between colonial organisms and multicellular organisms

Colonial Organization:

The organization in which many cells live together as independent organisms e.g. Volvox. Volvox is a colony of cells i.e., there is loose association of cells. There is cooperation of labour among them, no tissues and organs are not formed. Hundreds of volvox cells make a colony

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Volvox Colony

Multicellular Organization:

The organisms that consist of many cells are called multicellular organisms. In multicellular organization cells are organized in the form of tissues, organs and organ systems. Frog and mustard are the familiar examples of multicellular organization.

The different functions performed by different cells and tissues are called division of labour. As a cell or tissue becomes more specialized, it becomes increasingly more and more dependent on its fellow cells. For example, a muscle cell depends on blood cells for its need of oxygen.

Q5. What is the importance of horticulture?

Ans: Horticulture:

Horticulture means the art of gardening. Field of Biology deals to the art of gardening is called horticulture.

The careers involved are plant breeders, horticulturist etc.

Importance of horticulture:

Horticulture is a branch of agriculture that deals to the science, technology and business of plant cultivation. It includes developments of the gardens, cultivation of fruits, vegetables, nuts, flowers seeds, mushrooms, etc.

Horticulture refers to small-scale gardening. The word horticulture comes from Latin and means "garden cultivation."

Q6. What is meant by division of labour among multicellular organisms?

Ans: Division of labour among multicellular organisms:

The different functions performed by different cells and tissues are called division of labour in multicellular organisms.

As a cell or tissue becomes more specialized, it becomes increasingly more and more dependent on its fellow cells. For example, a muscle cell depends on blood cells for its need of oxygen.

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EXTENSIVE QUESTIONS

Q1. How biology is related with other sciences? Show and explain the link.

OR

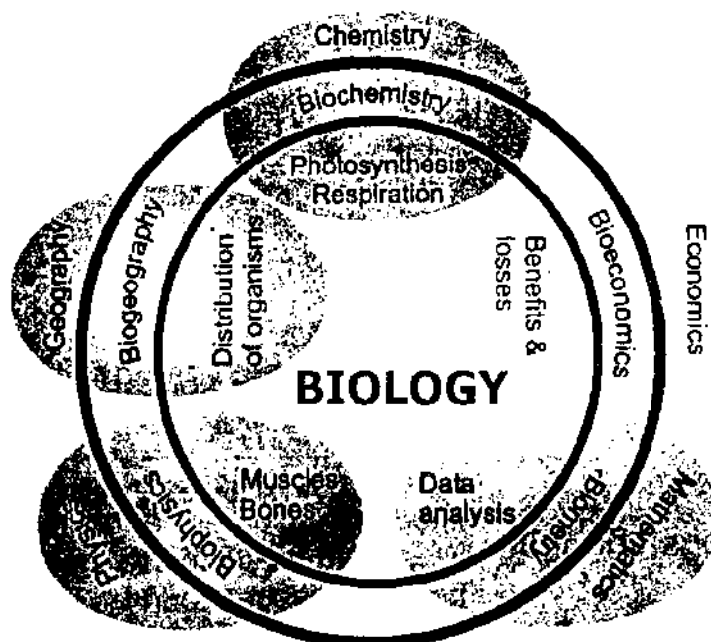
Give points to advocate that Biology is linked with physics, chemistry, mathematics, geography and economics?

Ans: Relationship of biology to other sciences:

The biology is not an isolated science. It is associated with other branches of science.

The interrelationship among different branches of science cannot be denied. Biology includes information on various aspects of living things but these information relate to the other branches of science as well.

Each branch of science has relationship with all other branches. For example, when studying the process of movement in animals, the biologists have to refer to the laws of motion in physics. This forms the basis of **interdisciplinary sciences**.



Relationship of biology with other sciences

a. Biophysics:

Biological organisms work on the principles of physics e.g., movement of muscles and bones. The study of biological phenomena on the principles and laws of physics is called biophysics.

b. Biochemistry:

The study of chemical constituents found in an organism and chemical reactions taking place in the living organism is called biochemistry. Living

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organisms consist of carbon, hydrogen, oxygen, nitrogen, etc., and chemical reactions such as digestion of food, respiration, and photosynthesis take place in the organism.

c. Biometry:

Statistics is related to collecting and analysing various data or facts. The collection of biological data of facts through observations, experiments and analysing them for biological study and its application.

d. Biogeography:

The study of distribution of plants and animals in different geographical regions of the world is called biogeography.

e. Bioeconomic:

The study of biology from economic point of view is called bioeconomic. Production of wheat, fish, rice and their export value etc., are the examples of bioeconomic.

Q2. How biology can lead to career of medicine, surgery, fisheries, agriculture, animal husbandry, biotechnology, horticulture, farming, forestry.

Ans: Careers that require a background in biology:

The new emerging careers of biology include bioinformatics and biomedical engineering.

The following are the careers that a student of biology can plan to adopt.

Medicine:

MBBS stand for bachelor of medicine and bachelor of surgery. Medicine is the diagnosis and treatment of different diseases.

Surgery:

Surgery is the branch which treats diseases by removal, or replacement of the defective parts or organs. After MBBS a student can specialize in various fields of medicine and surgery.

Fisheries:

Careers associated with fisheries are wild life specialist, fishery biologist and improvement of fish production.

Agriculture:

Agriculture means to cultivate land. It is the growth of crops and animals to provide food, wool and other products. Careers associated with agriculture are food scientist, agricultural engineer, agricultural entomologist etc.

Farming:

The profession in which different types of farm (e.g. poultry farm, fruit farm, buffalo farm etc.) are developed and maintained.

A student who has gone through the professional course of agriculture, animal husbandry or fisheries etc. can adopt this profession.

Animal Husbandry:

Animal husbandry is the care and breeding of domestic animals. The careers associated with animal husbandry are vet, animal breeders, animal trainer etc.

Biotechnology:

Biotechnology is the use of living organisms or their components to make useful products. The careers associated with biotechnology are bacteriologist, virologist, molecular geneticist, biotechnologist etc.

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Horticulture:

Horticulture means the art of gardening. The careers involved are plant breeders, horticulturist etc.

Forestry:

It is the science of planting, managing and caring for forests. The careers related to forestry are forest officer, forest ecologist, environmental engineer etc.

Q3. Give an account of levels of biological organization.

Ans: The Levels of biological Organization:

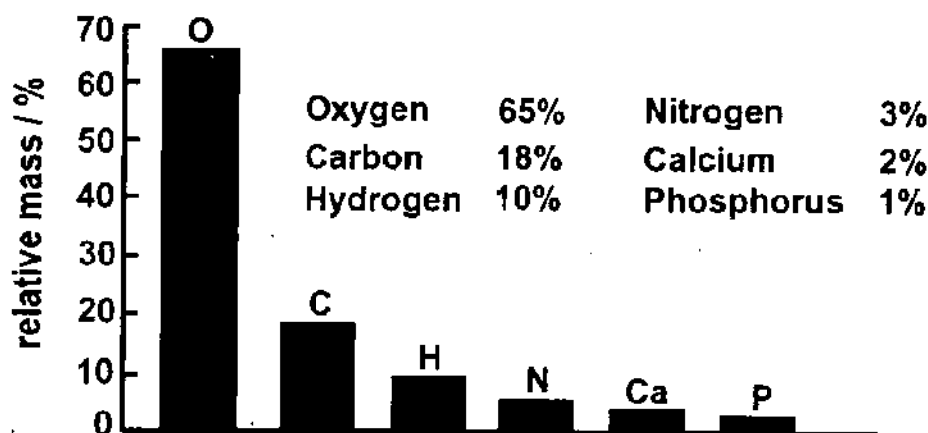
In order to understand the various phenomena of life, biologists study biological organization at different levels, which are as follows.

Bioelements:

About 16 of the 92 natural elements are essential to life. These are called bio-elements.

Out of these bioelements:

- Only six (O, C, H, N, Ca and P) make 99% of the total mass.
- Other ten (K, S, Cl, Na, Mg, Fe, Cu, Mn, Zn and I) collectively make 01% of the total mass.



Percentage composition of six bio-elements, by mass of a human being

Biomolecules:

Molecules that are found only in living organisms are called biomolecules. The four fundamental kinds of biological molecules are carbohydrates, proteins, lipids and nucleic acids.

Micromolecules:

The small biomolecules in living things are called micromolecules. These are sugars, fatty acids, amino acids and nucleotides. Each of the small molecules can be a unit of large bio-molecules.

Macromolecules:

The large organic molecules are called macromolecules. For example, starch, protein, DNA etc.

The Level of Organization and its explanation:

The Level of Organization, its explanation and example are given in the following table.

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Level of Organization	Explanation	Example
Atomic Level	Atoms are defined as the smallest unit of an element that still maintains the property of that element.	Carbon, Hydrogen, Oxygen
Molecular Level	Atoms combine to form molecules which can have entirely different properties than the atoms they contain.	Water, DNA, Carbohydrates
Organelle Level	Biomolecules assemble in a specific way to form organelle. Organelles are sub-cellular structure.	Nucleus, ribosomes
Cellular Level	Cells are the smallest unit of life. Cells are enclosed by a membrane or cell wall and in multicellular organisms often perform specific functions.	Muscle cell, Skin cell, Neuron
Tissue Level	Tissues are groups of cells with similar functions.	Muscle, Epithelial, Connective
Organ Level	Organs are two or more types of tissues that work together to complete a specific task.	Heart, Liver, Stomach
Organ System Level	An organ system is group of organs that perform related functions	Digestive System, Circulatory System
Organism Level	An organism has several organ systems that function together	Human

BIOLOGY NOTES FOR 9TH CLASS

Q4. Compare unicellular, colonial and multicellular organization in organisms.

Ans:

Unicellular Organization	Multicellular Organization	Colonial Organization
The organisms that consist of only one cell are called unicellular organisms.	The organisms that consist of many cells are called multicellular organisms.	The organization in which many cells live together as independent organisms.
Examples of unicellular organisms are bacteria, archaea, unicellular fungi, and unicellular protists	Frog and mustard are the familiar examples of multicellular organization.	Volvox is a colony of cells i.e., Hundreds of Volvox cells make a colony.
All life activities are carried out by single cell.	Cells are organized in the form of tissues.	There is loose association of cells.
Division of labour is at the organelle level and composed of only one cell.	Division of labour is at cellular, tissue, organs and organ system level.	There is no division of labour among them so tissues and organs are not formed.
A lifespan of a unicellular organism is usually short.	Multicellular organisms have a comparatively longer lifespan.	Groups of independent cells that live in colonies (all cells are the same)
Each cell is independent organism and can carry out all life functions.	Multicellular organisms have specialised tissues that perform specific functions.	In colonial organisms, little or no independence with their neighbours. They don't help each other.

Q5. How is biotechnology useful for society?

Ans: Biotechnology could help address many global problems, such as climate change, an aging society, food security, energy security and infectious diseases, to name just a few.

Benefits of Biotechnology:

- It can improve health and reduce hunger simultaneously
- It creates flexibility within the food chain.
- It offers medical advancement opportunities.
- It allows us to preserve resources.
- It helps us minimize or eliminate waste products.
- It can reduce infectious disease rates.

Q6. Why is biology important for the welfare of human beings? Give reasons.

Ans: Biology is important to everyday life because it allows humans to better understand their bodies, their resources and potential threats in the environment.

BIOLOGY NOTES FOR 9TH CLASS

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The science of biology has been helping mankind in much way in increasing food production; in combating diseases and in protecting and conserving environment.

Biological advances in the field of food and health have resulted in high standard of living. Biology helps us get a detailed view about our body and all the other living beings in the planet. It helps scientists to create new formulas, and helps them to advance the human civilization. Pursuing a career in biology can be immensely rewarding and exciting. There are several applied fields in biology that you can select as a career in medicine, surgery, fisheries, agriculture, animal husbandry, biotechnology, horticulture, farming and forestry etc.

In the course of biology, we will study how man has thought about living things. To understand and appreciate nature, it is essential to study the structures, functions and related aspects of living organisms. The study of living organisms also provides information and remedies to human problems regarding health, food, environment etc.

THE TERMS TO KNOW

1. **Agriculture:** The science, art, and business of cultivating soil, producing crops, and raising livestock; farming.
2. **Animal husbandry:** The profession in which the diseases of livestock are diagnosed and treated.
3. **Biochemistry:** The science that deals with the study of the chemistry of different compounds and processes occurring in living organisms.
4. **Bioeconomics:** The science that studies the organisms from economical point of view.
5. **Bioelement:** Elements that make the body of living organisms.
6. **Biogeography:** The science that studies the occurrence and distribution of different species of living organisms in different geographical regions of the Earth.
7. **Biomolecule:** The molecules of life.
8. **Biophysics:** The science that covers the relationship of biology with physics.
9. **Botany:** The division of biology that deals with the study of plants.
10. **Cell:** The structural and functional unit of life.
11. **Colony:** Group of the unicellular organisms that do not have division of labour among themselves.
12. **Embryology:** The study of the development of a new individual from a fertilized egg (zygote).
13. **Farming:** The profession in which different types of farm (e.g. poultry farm, fruit farm, buffalo farm etc.) are developed and maintained.
14. **Fisheries:** The profession of fish production.
15. **Forestry:** The profession in which the professionals look after natural forests and suggest for planting and growing artificial forests.

BIOLOGY NOTES FOR 9TH CLASS

16. **Fossil:** Remains or impressions of an organism that existed in the geological past.
17. **Horticulture:** The growing of garden plants; the cultivation of fruit and vegetables.
18. **Inheritance:** The transmission of characters from one generation to the other.
19. **Macromolecule:** The biomolecules with higher molecular weight.
20. **Micromolecule:** The biomolecules with lower molecular weight.
21. **Microorganism:** Any organism (living thing) that cannot be seen with the naked eye. (micro = small, 10^{-6} cm)
22. **Organ:** Group of tissues doing a particular job e.g. the heart.
23. **Organ system:** Group of organs doing a particular job, e.g. the circulatory system.
24. **Parasite:** An organism that lives in or on another organism of different species and causes harm to it.
25. **Population:** Members of a single species living in a habitat.
26. **Surgery:** The profession in which the parts of the body may be repaired, replaced or removed in order to treat a disease or any other malfunctioning.
27. **Volvox:** A green alga found in water that shows colonial organization.

MULTIPLE CHOICE QUESTIONS

- Members of the same species living in the same place at the same time make a;**
A. Habitat
B. Biosphere
C. Community
D. Population
- If a scientist is studying the methods of inserting human insulin gene in bacteria, which branch of biology may this be?**
A. Anatomy
B. Physiology
C. Biotechnology
D. Pharmacology
- Which one will be the correct sequence of the levels of organization of life?**
A. Cell, organelle, molecule, organ, tissue, organ system, individual
B. Molecule, tissue, organelle, cell, organ system, organ, individual
C. Molecule, organelle, cell, tissue, organ, organ system, individual
D. Organ system, organ, tissue, cell, molecule, organelle, individual
- Which of these major bioelements is in the highest percentage in protoplasm?**
A. Carbon
B. Hydrogen
C. Oxygen
D. Nitrogen
- Which of the following group includes organisms all of which are absorptive in their nutrition?**
A. Protists
B. Animals
C. Bacteria
D. Fungi

BIOLOGY NOTES FOR 9TH CLASS

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6. Similar cells organized into groups and performing same functions are known as;
A. Organelle B. Tissue
C. Organ D. Organdy stem
7. Which of these tissues also makes the glandular tissue in animals?
A. Epithelial tissue B. Muscular tissue
C. Connective tissue D. Nervous tissue
8. The level of organization that is less definite in plants is;
A. Tissue level B. Organ level
C. Organ system level D. Individual level
9. What is TRUE about volvox?
A. Unicellular eukaryote B. Unicellular eukearyote
C. Multicellular eukaryote D. Organ system level
10. When we study the feeding relations among different animal species of a forest, at what level of organization we are studying?
A. Individual B. Population
C. Community D. Biosphere

ANSWERS:

1. D	2. C	3. C	4. C	5. D
6. B	7. A	8. C	9. C	10. C

MULTIPLE CHOICE QUESTIONS

1. The study of the structure of internal organs is.
A. Physiology B. Biotechnology
C. Pharmacology D. Anatomy
2. The profession in which the diseases of livestock are diagnosed and treated is known as:
A. Biotechnology B. Pharmacology
C. Animal husbandry D. Entomology
3. The structural and functional unit of life is:
A. Cell B. Tissue
C. Organ D. Nucleus
4. Populations of different organisms living together in a habitat is called:
A. Colony B. Community
C. Ecosystem D. Forestry
5. The study of insects is called:
A. Immunology B. Embryology
C. Taxonomy D. Entomology

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6. The branch that deals with the study of the interactions between the organisms and their environment is:
A. Environmental biology B. Embryology
C. Community D. Taxonomy
7. Remains or impressions of an organism that existed in the geological past:
A. Protist B. Volvox
C. Fossil D. Organelle
8. The study of inheritance is called:
A. Histology B. Genetics
C. Taxonomy D. Morphology
9. The microscopic study of tissues is done in:
A. Embryology B. Taxonomy
C. Morphology D. Histology
10. The study of the structures of living organisms:
A. Histology B. Morphology
C. Embryology D. Taxonomy
11. Group of tissues doing a particular job is called:
A. Cell B. System
C. Organ D. Organelle
12. Microscopic structure which does a particular job in a cell, is known as:
A. Organelle B. System
C. Organ D. Cell
13. It is the study of fossils, which are the remains of extinct organisms. Paleontologists study the age and structure of fossils and on this basis study the process of evolution is called:
A. Palaeontology B. Taxonomy
C. Morphology D. Histology
14. An organism that lives in or on another organism of different species and causes harm to it is describe as:
A. Organelle B. fungi
C. Volvox D. Parasite
15. The study of parasites is done in:
A. Histology B. Embryology
C. Parasitology D. Taxonomy
16. If a scientist is studying drugs and their effects on the systems of body, which branch of biology may this be?
A. Histology B. Taxonomy
C. Embryology D. Pharmacology
17. The study of the functions of living organisms and their parts called
A. Immunology B. Physiology
C. Parasitology D. Palaeontology
18. Members of a single species living in a habitat:
A. Population B. Ecosystem
C. Forestry D. Colony

BIOLOGY NOTES FOR 9TH CLASS

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- 19. Unicellular organisms that do not have distinct nucleus in their cells e.g. bacteria are called:**
 A. Protista B. Saccharum
 C. Prokaryote D. Canis Lupis
- 20. The group that includes unicellular or simple multicellular organisms with distinct nuclei in their cells e.g. Euglena, Paramecium, Green algae is called:**
 A. Fungi B. Protist
 C. Family D. Monera
- 21. The study of the naming and classification of organisms into groups and subgroups:**
 A. Anatomy B. Histology
 C. Morphology D. Taxonomy
- 22. Group of cells of the same type doing a particular job, is called:**
 A. Organs B. Tissue
 C. System D. Cells
- 23. A green alga found in water that shows colonial organization:**
 A. Euglena B. Paramecium
 C. Amoeba D. Volvox

ANSWERS:

1. D	2. C	3. A	4. B	5. D
6. A	7. C	8. B	9. D	10. B
11. C	12. A	13. A	14. D	15. C
16. D	17. B	18. A	19. C	20. B
21. D	22. B	23. D		

BIOLOGY NOTES FOR 9TH CLASS

UNIT-02
SOLVING A BIOLOGICAL
PROBLEM

CHAPTER WISE NOTES

Q1. State the main purpose of biology.

Ans: Biology is concerned not only with learning about organisms but its main purpose is to solve the biological problems faced by human beings. For example, biology has helped us to know the cause and cure of many diseases.

Q2. Make a list of symptoms of malaria.

Ans: Symptoms of Malaria:

- i. The patient of malaria feels very chill and cold.
- ii. His/her temperature rises above normal value of 98.6°F.
- iii. The patient suffers from headache and has feeling of nausea.
- iv. After some time, the person begins to sweat, feels better.
- v. The whole series of events are repeated after every 24, 48 or 72 hours depending upon the species of Plasmodium.

Q3. How does malaria spread?

Ans: Spread of malaria:

Biological method helped to find that mosquitoes spread malaria.

Q4. Explain that how recognition of the problem is an important step in solving a biological problem?

Ans: Recognition of the problem:

Malaria is a fatal disease since ancient times. After the confirmation that malaria is caused by Plasmodium, it was to find how Plasmodium gets into the blood of man. This disease was more common in areas near stagnant water ponds where mosquitoes breed. It was found that;

- a. Malaria is associated with marshes.
- b. Drinking water of marshes does not cause malaria.

From these points, it can be concluded that Plasmodium was not present in the marshy water. So Plasmodium must be carried by something that comes to marsh water. Problem in this study was to find that agent.

Q5. What prevent blood clotting in the food canal of the mosquito?

Ans: When a female mosquito pierces the skin with the mouthparts, a small amount of saliva is injected into the wound before drawing blood. The saliva prevents the blood from clotting in the food canal of the mosquito.

Q6. State the term "vector"?

Ans: Vector:

The word vector means transmitter. Any organism which carries a parasite and transfers it from one organism to another is called vector.

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Q7. What is the treatment of malaria?

Ans: Treatment of malaria:

For the treatment of malaria, quinine extracted from the bark of Cinchona plant is used. Apart from quinine certain other anti-malarial drugs are also used for the treatment.

Q8. What type of disease is Dengue Fever? How can we prevent from dengue fever?

Ans: Dengue Fever:

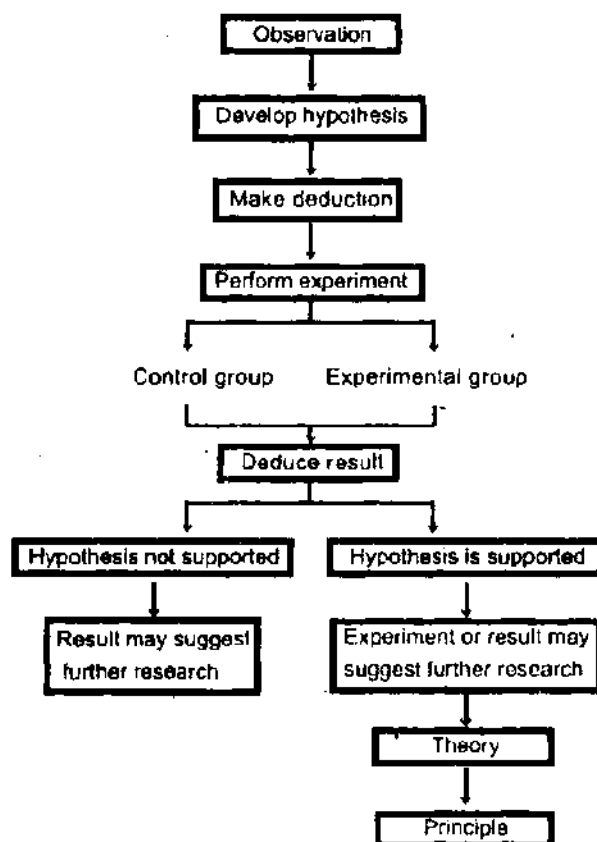
It is a mosquito-borne viral disease. It is caused by a Dengue virus and transmitted by mosquito *Aedes aegypti*, which has zebra like white and black stripe on its body. Typical case of Dengue haemorrhage fever is characterized by high fever, bleeding from nose, blood in urine and enlarged liver etc.



There is no specific antiviral drug available for the treatment of patients suffering from Dengue fever. The second attack can be more serious and dangerous. The best prevention is personal protection from mosquito bite and measures to prevent mosquito breeding.

Q9. Draw a flowchart to show scientific method of study.

Ans:



Scientific method of study

BIOLOGY NOTES FOR 9TH CLASS

Q10. Briefly explain how theory, law and principle are formulated?

Ans: Theory, Law and Principle:

The ultimate goal of science is to understand natural world in term of theories. If the hypothesis is found to be correct then it becomes a theory. It is supported by a number of evidences. A theory can be changed if better evidence is available. For example, the theory of evolution. A theory that has been verified and appears to have wide application may become biological principle or law. For example, Mendel's law of inheritance.

Q11. Differentiate between data and data analysis.

Ans: Data and Data Analysis:

The collection of facts or information is called data. First data is collected then data is organized by using techniques such as tables and graphs. To predict on the basis of data is called analysis. Analysis of data is done by means of ratio and proportion.

SUMMARY

1. Scientific method is a system of observing and recognizing problem, developing hypothesis, making a prediction that can be tested, performing experiments and drawing conclusions from the result that support or testify the hypothesis.
2. Data is the collection of facts.
3. A hypothesis is a possible explanation for a group of related observations.
4. Deduction is the logical explanation of hypothesis.
5. Data is organized by using techniques such as table and graphs. Analysis of data is done by means of ratio and proportion. Data analysis is important for confirming modifying or rejecting a hypothesis.
6. Mathematics is used in science for the expression of scientific model. Studying mathematics develops reasoning ability.

EXERCISE

(MCQs)

- **Select the correct answer:**
1. The starting point of scientific investigation is _____.
A. hypothesis B. theory
C. observation D. data
2. Information that is gathered as a result of an experiment is called:
A. hypothesis B. Observation C. theory D. data

BIOLOGY NOTES FOR 9TH CLASS

3. Which of the following represents the correct sequence of different steps of scientific study?
- observation, → hypothesis → experiment → deduction → theory
 - observation, → deduction → hypothesis → theory → experiment
 - hypothesis → observation → deduction → experiment → theory
 - observation → hypothesis → deduction → experiment → theory
4. Which of the following best describes the logic of the scientific process?
- if I generate a testable hypothesis, tests and observations will support it
 - if my prediction is correct, it will lead to a testable hypothesis
 - if my observations are accurate, they will support my hypothesis
 - if my hypothesis is correct, I can expect certain test results
5. Which of the following statements best distinguishes hypothesis from theories in science?
- theories are hypothesis that have been proven true
 - theories are based on limited data while hypothesis are based on wide range of data
 - theories are uncertain while hypothesis are certain
 - theories are educated guess while hypothesis are widely accepted explanation of natural phenomenon
6. You are doing a control experiment which _____.
- proceeds slowly enough that a scientist can record the results
 - may include experimental groups and control groups tested in parallel
 - is repeated many times to make sure the results are accurate
 - proceed slowly enough that a scientist can test predictions
7. Malaria is caused by _____.
- mosquito
 - stagnant water
 - swamp
 - Plasmodium
8. The comparison of one number to another number is called a ____.
- ratio
 - proportion
 - mean
 - frequency
9. Two equal ratios joined by the sign of equality (=) form a _____.
- ratio
 - frequency
 - proportion
 - median
10. Plasmodium was first observed in malarial patient by _____.
- Laveran
 - A.F.A. King
 - Ronald Ross
 - Aristotle

ANSWERS:

1. C	2. C	3. D	4. C	5. A
6. C	7. D	8. A	9. C	10. B

BIOLOGY NOTES FOR 9TH CLASS

SHORT QUESTIONS

Q1. What is the contribution of the following scientists?

- a. **A.F.A King** b. **Ronald Ross**

Ans: a. Contribution of A.F.A King:

In 1882, King proposed a method to eradicate malaria from Washington, DC. His method was to encircle the city with a wire screen as high as the Washington Monument. Many people took this as a jest, partly because the link between malaria and mosquitoes had, at that time, been hypothesized by only a few physicians. It was not until 1898 that Ronald Ross proved mosquitoes were a vector for malaria (he won the Nobel Prize for the discovery just four years later).[8] However impractical, King was on the right track for malaria control, well in advance of the rest of the medical profession.

Result of Observations

From the observations, it can be concluded that Plasmodium was not in the marsh water. But it must be carried by something that comes to marsh water. In 1883, a physician **A.F.A King** listed 20 observations. Some important observations of King were:

- People who slept outdoors were more likely to get malaria than those who slept indoors.
- People who slept under fine nets were less likely to get malaria than those who did not use such nets.
- Individuals who slept near a smoky fire usually did not get malaria.

Suggestions of A.F.A King about Malaria

On the basis of the above observations, King suggested a hypothesis:

"Mosquitoes transmit Plasmodium and so are involved in the spread of Malaria."

Following deductions were made considering the hypothesis as true i.e. if mosquitoes are involved in the spread of malaria then:

"Plasmodium should be present in mosquitoes."

"A mosquito can get Plasmodium by biting a malarial patient."

b. Contribution of Ronald Ross:

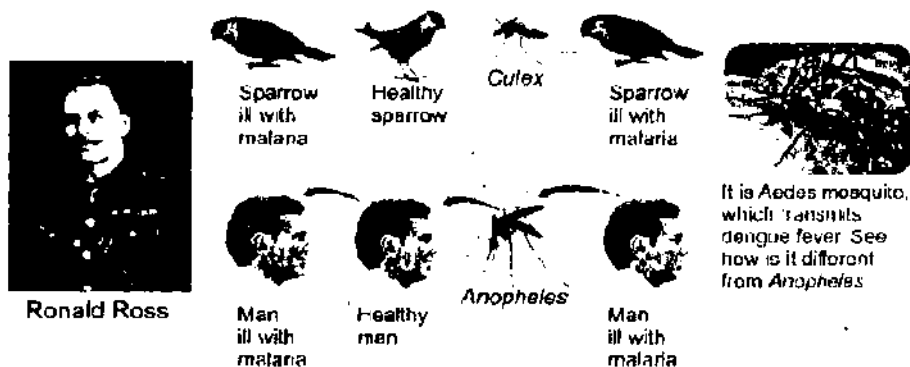
Ronald Ross was awarded the Nobel Prize for Physiology or Medicine in 1902 "for his work on malaria, by which he has shown how it enters the organism and thereby has laid the foundation for successful research on this disease and methods of combating it".

Experiments of Ronald Ross:

Ross, a British army physician working in India performed an important experiment. He allowed a female Anopheles mosquito to bite a malarial patient. He killed the mosquito some days later and found Plasmodium multiplying in mosquito's stomach.

Next Ross used sparrows in his experiments. He allowed female Culex mosquitos to bite on the sparrows suffering from malaria. He then allowed these mosquitoes to bite healthy sparrows. The sparrows got malaria.

BIOLOGY NOTES FOR 9TH CLASS



Malaria in man is transmitted by Anopheles and in birds by Culex

Q2. What is the importance of data organization and data analysis in biological sciences?

Ans: Importance of Data organization:

- In order to formulate and then to test the hypotheses scientists collect and organize data.
- Prior to conducting an experiment it is very important for a scientist to describe the data collection methods. It ensures the quality of the experiment.
- Data is organized in different formats like graphics, tables, flow charts, maps and diagrams.

Importance of Data Analysis:

Data analysis is important for rejecting, modifying or confirming a hypothesis.

i. Rejecting a Hypothesis:

Malaria occurs in marshy places. Based on this data the hypothesis will be:

Marshy water causes malaria:

20 persons drank marshy water

No one suffered from malaria. So, the hypothesis is rejected on the basis of data that 20 persons drank marshy water and did not suffer from malaria.

ii. Modifying Hypothesis:

After rejection of "Marshy waters as cause of malaria" hypothesis was modified on the basis of other observations.

Modified hypothesis: "Plasmodium is the cause of malaria".

iii. Confirming Hypothesis:

Data analysis of repeated experiments confirmed the hypothesis that "Plasmodium is the cause of malaria".

Q3. Can you distinguish between ratio and proportion?

Ans: Ratio:

The comparison of one number to another number is called a ratio.

Ratio may be expressed by putting a division (+) or colon (:) mark between the two numbers.

Problem: What is the ratio between 105 red flowers and 35 white flowers?

Solution:

105	:	35
21	:	7
3	:	1

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Proportion:

Two equal ratios joined by the sign equality (=) form a proportion.

Thus $\frac{a}{b} = \frac{c}{d}$ is a proportion.

Proportion means to join two equal ratios by the sign of equality (=). For example; $a:b = c:d$ is a proportion between the two ratios. This proportion may also be expressed as $a:b::c:d$.

Explanation:

Ratio and proportion are used in solving biological problems. It is used to calculate expected results of biological experiments. Imagine flipping a coin each time you flip the coin there is a 50% chance of heads and 50% chance of tails

In an experiment 30 sparrows were subjected to mosquito bite, 24 of which got malaria. If 100 sparrows were bitten by mosquito how many got malaria?

$$\frac{x}{100} = \frac{24}{30} \Rightarrow x = \frac{100 \times 24}{30} = \frac{2400}{30} \Rightarrow x = 80$$

Q4. Why it is impossible to eradicate (eliminate) malaria?

Ans: Malaria is a difficult disease to control largely due to the highly adaptable nature of the vector and parasites involved. There is no specific antiviral drug available for the treatment of patients suffering from malaria fever. The best prevention is personal protection from mosquito bite and measures to prevent mosquito breeding.

Q5. What was the main purpose of experiment by Ronald Ross?

Ans: Sir Ronald Ross is famous for being the discoverer of the mosquito transmission of malaria. Because female culex mosquito is the only mosquito which can spread malaria, it was confirmed during experiments by Ronald Ross that mosquitoes transmit Plasmodium and spread malaria. All these experiments confirmed that mosquito transmit Plasmodium and spread malaria.

Q6. Why Ross did not allow the infected mosquitoes to bite a healthy person?

Ans: Experimenting on human might be result in malaria in human and could cause death. Ross used sparrows instead of humans in his experiments. He allowed female Culex mosquitos to bite on the sparrows suffering from malaria. He then allowed these mosquitoes to bite healthy sparrows. The sparrows got malaria.

Q7. Justify mathematics as an integral part of the scientific studies.

Ans: Mathematics as an integral part of scientific process:

Mathematics is essential to many sciences. The most important function of mathematics in science is the role it plays in the expression of scientific models. Studying mathematics develops reasoning ability.

As a result of this mathematics plays a very important role in physical science. In case of biological science, genetics and other involvement as a complex mathematical relation.

Q8. What ways do you use the scientific method in everyday life?

Ans: Scientific method in everyday life:

We use scientific method when performing and executing an experiment. The purpose of the scientific method is to have a systematic way of testing ideas and reporting results in the process of scientific inquiry. A key component of the use of the scientific method is that it ensures that the experiment should be able

BIOLOGY NOTES FOR 9TH CLASS

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to be replicated by anyone. If that is not possible, then the results are considered invalid.

Scientists, including biologists, employ an approach for solving scientific problem that is known as the scientific method.

Scientific method has the following steps:

- i. Recognition of a biological problem
- ii. Observation and identification of scientific problem.
- iii. Hypothesis formulation.
- iv. Drawing deductions.
- v. Devising experiment.
- vi. Summarization of results (create tables, graphics etc)
- vii. Reporting the results.

EXTENSIVE QUESTIONS

Q1. Discuss biological method of study and their application.

Ans: Biological techniques are methods or procedures that are used to study living things. They include experimental and computational methods, approaches, protocols and tools for biological research.

Biological method of study and their application:

Scientists, including biologists, employ an approach for solving scientific problem that is known as the scientific method.

Steps of biological method:

In resolving biological problem, biologists takes the following actions / steps:

- i. Recognition of a biological problem / issue
- ii. Observation and identification
- iii. Building up / formulation of hypothesis
- iv. Drawing deductions
- v. Devising experiment
- vi. Inferring result

Scientific problem, hypothesis, deduction and experiments:

Malaria has killed more people than any other disease. The malaria is an example of a biological problem and how such problems can be solved.

Study of malaria an example of biological method:

Biological problems are solved by a series of steps of biological method.

- i. **Recognition of the biological problem:** Biological problem is a question related to living organisms. This question is either asked by someone or comes in mind of researcher.
- ii. **Observations:** Observations are very important step in solving a biological problem. Observations are made by five senses of vision, hearing, smell, taste and touch. Observations are of two types;
Qualitative observations; which are based on some quality or characteristic.
Quantitative observations; which are based on measurable value.

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Quantitative observations being measurable are invariable and can be expressed in terms of numbers, so are more accurate.

iii. **Formulation of Hypothesis:** Hypothesis is a statement that may prove to be the answer of the biological problem under study. Hypothesis is a tentative explanation of the observations that might be true. A hypothesis should have following characteristics;

- a. It should be a general statement.
- b. It should be tentative idea.
- c. It should agree with the available observations.
- d. It should be testable and potentially falsifiable.

iv. **Deductions:** Deductions are the logical consequences of the hypothesis. To draw deductions hypothesis is taken as true. Deductions involve "if" and "then" logic.

v. **Experimentation:** It is the most important step of biological method. Experiments are performed to prove if hypothesis is true or not. The deductions drawn from the hypothesis are subjected to rigorous testing. Through experimentation, biologist learns which hypothesis is correct.

vi. **Summarization of the results:** The biologist gathers actual quantitative data from experiments. This data arranged to draw results. It allows other people to verify the results or apply the knowledge to solve other problems.

Q2. How a biological problem is solved? Explain with reference to malaria.

Ans: A biological problem is a question related to living organisms that is either asked by some one or comes in biologist's mind by himself. e.g. What is the cause of malaria?

Solving a biological problem with reference to malaria: By adopting the steps of biological method, it was proved that malaria is caused by Plasmodium.

Recognition of the problem:

Malaria was a problem since ancient times. It has killed more people than any other disease.

Observations: In 19th century, many different causes of malaria were being suggested. By that time, there were four major observations about malaria.

- a. Malaria and marshy areas have some relation.
- b. Quinine is an effective drug for treating malaria.
- c. Drinking the water of marshes does not cause malaria.
- d. Plasmodium is seen in the blood of malarial patient.

Hypothesis: Based on these observations and other information, following hypothesis was formulated. ***"Plasmodium is the cause of malaria"***.

Deduction: Although hypothesis is a tentative idea, to draw deductions it is accepted to be true. One of the deductions from the above hypothesis was;

"If Plasmodium is the cause of malaria, then all persons ill with malaria should have Plasmodium in their blood".

Experiments: This deduction was tested through experiment. Experiment was designed as; Blood of 100 patients was examined under microscope. For the purpose of having control group, the blood of 100 healthy persons was also examined under microscope.

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Results: The results of experiments showed that almost all malarial patients had Plasmodium in their blood. Only 07 out of 100 healthy persons had Plasmodium in their blood. Other 93 healthy persons were without any trace of Plasmodium in their blood. In the 07 healthy persons with Plasmodium in their blood, Plasmodium was in incubation period. The incubation period is time between the entry of parasite in the host and the appearance of the symptoms of disease.

Results were quite convincing to prove the hypothesis that "Plasmodium is the cause of malaria".

Reporting the results: Results of these experiments were announced worldwide which helped to control malaria.

THE TERMS TO KNOW

1. **Data:** Data can be defined as a single piece of information such as names, dates or values made from observations and experimentation.
2. **Deduction:** The logical consequence of the hypothesis.
3. **Experiment:** An experiment is an activity performed under suitable conditions with specially designed instrument to get the required information.
4. **Hypothesis:** The tentative statement that may prove to be the answer of a scientific problem.
5. **Observation:** The process of observing natural phenomena with the help of five senses and the scientific equipments.
6. **Principle:** A theory that has been verified and appears to have wide application may become biological principle.
7. **Proportion:** Proportion means to join two equal ratios by the sign of equality (=). For example; $a:b = c:d$ is a proportion between the two ratios. This proportion may also be expressed as $a:b::c:d$. When three values in a proportion are known, the fourth one (x) can be calculated.
8. **Ratio:** The comparison of one number to another number is called a ratio. Ratio may be expressed by putting a division (+) or colon (:) mark between the two numbers.
9. **Theory:** If a hypothesis is accepted (after discussion and experimentation) it is called a theory.

MULTIPLE CHOICE QUESTIONS

1. Which one of the following is a correct sequence in biological method?
A. Observations, Hypothesis, Law, Theory
B. Hypothesis, Observations, Deduction, Experimentation
C. Observations, Hypothesis, Deduction, Experimentation
D. Law, Theory, Deduction, Observations

BIOLOGY NOTES FOR 9TH CLASS

- =====
2. Which one of these is NOT a characteristic of a hypothesis?
- A. Must be consistent with all available data
 - B. Must be testable
 - C. Must be correct
 - D. Must make predictions
3. At which point is a biologist most likely to use deductive reasoning?
- A. While taking observations
 - B. During hypothesis formulation
 - C. During data organization
 - D. None of the above
4. A hypothesis must be testable to be scientifically valid. Being testable means that _____.
- A. Some observation could prove the hypothesis incorrect
 - B. Only a controlled experiment can indicate whether the hypothesis is correct or incorrect
 - C. The hypothesis has been proven wrong
 - D. The opposite of hypothesis is tested and proven wrong.
5. What would be the best experimental design for testing a hypothesis that bean plants require sodium?
- A. Measure the amount of sodium in a few bean plants
 - B. Grow bean plants with and without sodium
 - C. Look for sodium in leaf tissues
 - D. Analyze root contents for sodium
6. A gardener sees a large snake nearby. He knows that generally snakes sting, so the gardener ran away. The gardener did which of the following?
- A. Used reasoning
 - B. Used observation
 - C. Constructed a theory
 - D. Tested a hypothesis
7. A scientific theory has which of the following properties?
- A. It agrees with available evidence
 - B. It cannot be rejected
 - C. It has been absolutely proven
 - D. It does not need to be altered in the light of new evidence
8. Experimentation is only a step of the scientific process, but it is a very important step because it always _____.
- A. Gives the biologist a correct result
 - B. Allows rejection of some alternative hypotheses
 - C. Ensures that hypotheses can be confirmed with certainty
 - D. Gives scientists a chance to work in the laboratory
9. You are testing a hypothesis; "students learn more if a They drink tea before sitting for study". Your 20 experimental students drink tea before study; you test their learning by giving questions. Your 20 students of the control group should have all experimental conditions identical to the experimental group EXCEPT that;
- A. They should take tea with more milk and sugar
 - B. They should take tea before as well as during study
 - C. They should not take tea before study
 - D. After taking tea, they should not sit for study

BIOLOGY NOTES FOR 9TH CLASS

ANSWERS:

1. C	2. C	3. B	4. C	5. B
6. B	7. C	8. B	9. C	

MULTIPLE CHOICE QUESTIONS

- A common species of mosquito; bites mammals:**
 - Culex
 - Anopheles
 - Plasmodium
 - Cinchona
- The use of algorithms, computational and statistical techniques for the analysis of biological data.**
 - Biological method
 - Computational Biology
 - Bioinformatics
 - Biological Statistics
- A tree, the bark of which was used for the treatment of fevers:**
 - Cinchona
 - Culex
 - Quinine
 - Anopheles
- A species of mosquito; bites birds is called:**
 - Plasmodium
 - Quinine
 - Cinchona
 - Culex
- The logical consequence of the hypotheses:**
 - Induction
 - Law
 - Deduction
 - Ratio
- The tentative statement that may prove to be the answer of a scientific problem:**
 - Law
 - Hypothesis
 - Theory
 - Deduction
- Unicellular organism that causes malaria in mammals and birds etc.**
 - Plasmodium
 - Culex
 - Anopheles
 - Cinchona
- The medicines that kills Plasmodium and so cures malaria:**
 - Culex
 - Cinchona
 - Anopheles
 - Quinine
- Deductive reasoning;**
 - Is always correct
 - Uses specific observations to draw more general conclusions
 - Is not applied in biological method
 - Uses general observations to predict specific conclusions

ANSWERS:

1. B	2. C	3. A	4. D	5. C
6. B	7. A	8. D	9. D	

BIOLOGY NOTES FOR 9TH CLASS

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UNIT-03

BIODIVERSITY

CHAPTER WISE NOTES

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Q1. Why living things divided into different groups?

Ans: The living things have been divided into five major groups so that they can be identified easily. The similarity among living things is that they share all the characteristics of life, i.e., movement, respiration, sensitivity, nutrition, excretion, reproduction and growth. At the same time these living things differ from one another and their variety of appearance is enormous.

Q2. Differentiate between prokaryotes and eukaryotes.

Ans: The organisms which lack nucleus in their cells are called prokaryotes while the organisms which have nucleus in their cells are called eukaryotes.

Q3. Write the main difference between autotrophs, heterotrophs and saprotrophs?

Ans: Autotrophs:

The organisms that are capable of producing their own food are called autotrophs (photosynthetic mode of nutrition)

Example:

green plants, autotrophic bacteria, and algae.

Heterotrophs:

Organisms which eat other things as food are called heterotrophs (ingestive mode of nutrition)

Example:

animals, animal like protists, etc.

Saprotrophs:

The organisms that depend on dead, decaying matter are called saprotrophs (absorptive mode of nutrition)

Example:

fungi, bacteria. These are decomposers.

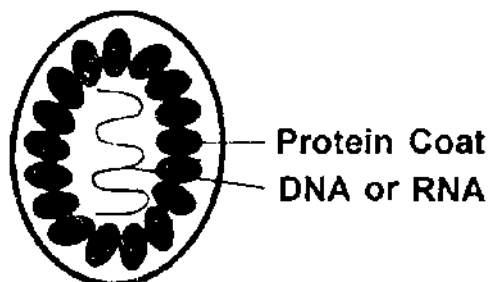
Q4. Briefly describe the structure of Virus.

Ans: Structure of Virus:

All viruses have a central core surrounded by a protein coat. Core can be of DNA or RNA. Following are the reasons why viruses are excluded from five kingdom classification:

- i. Viruses have no nucleus, cytoplasm, cell organelles or cell membrane.
- ii. They do not feed, respire, excrete or grow.
- iii. Viruses do reproduce, but only inside the cells of living organisms; usually the host cell provides materials.

BIOLOGY NOTES FOR 9TH CLASS



Structure of Virus

Q5. Write causes and symptoms of COVID-19. Highlight precautionary measures to stay safe.

Ans: COVID-19:

Corona viruses are a family of viruses that can cause illnesses such as the common cold. The virus is now known as the severe acute respiratory syndrome coronavirus 2. The disease it causes is called corona virus disease 2019 (COVID-19). The COVID-19 outbreak is a pandemic.



Causes of COVID-19:

It spreads mainly from person to person among those in close contact (within about 6 feet, or 2 meters). The virus spreads by respiratory droplets released when someone with the virus coughs, sneezes, breathes, sings or talks. These droplets can be inhaled or land in the mouth, nose or eyes of a person nearby.

Symptoms:

Most common symptoms: fever, dry cough and tiredness. Most infected people will develop mild to moderate illness and recover without hospitalization.

Precautionary measures :

A vaccine might prevent you from getting COVID-19. No medicine is available. Avoid close contact, wash your hands often with soap and water for at least 20 seconds, or use sanitizer. Cover your face with a cloth face mask in public spaces, avoid touching your eyes, nose and mouth. Stay home from work, school and public areas.

Q6. Differentiate between Prions and Viroid.

Ans: Difference between Prions and Viroid:

Prions	Viroid
Prions are infectious particles that are composed only of proteins, i.e., they contain no DNA or RNA.	Viroid consists of a single molecule of circular RNA without a protein coat or envelope.
They cause diseases in sheep and man.	They cause diseases in plants e.g., potato, apple etc.

Q7. Define species.

Ans: Species:

A species is defined as a group of organisms capable of interbreeding and producing fertile offspring.

BIOLOGY NOTES FOR 9TH CLASS

Q8. Write the features of Eucalyptus plants.

Ans: Eucalyptus plants:

Eucalyptus plants were imported from Australia and introduced in Pakistan. These plants consume more water and have disturbed the water table (level of underground water). It harms other small plants that grow near Eucalyptus trees.

SUMMARY

1. Biodiversity is the variety of the living organisms living in an ecosystem.
2. Biologists use a system of classification based on the similarities and differences in the organisms.
3. In Binomial system the name of each species has two parts the genus name and the specific epithet.
4. The five kingdom classification recognizes the kingdom: Monera, Protista, fungi, plantae and animalia.
5. Viruses cannot strictly be classified as living organisms. Each virus particle consists of a DNA or RNA core enclosed in a protein coat.
6. Although extinction is a natural phenomenon, human activities are causing a great increase in the rates of extinction of living organisms.
7. Conservation of species requires international agreements and regulations. These regulations may prohibit killing or collecting species and prevent trade in them or their products.
8. Deforestation and hunting are the two major issues of conservation of biodiversity in Pakistan.
9. Indus dolphin, Marco Polo sheep and Houbara Bastard are endangered in Pakistan.

EXERCISE

(MCQs)

• **Select the correct answer:**

- 1. Into which kingdom you place a multicellular land organism that carries on photosynthesis _____.**
- A. monera
B. protista
C. plantae
D. animalia
- 2. Which kingdom is mismatched with the characteristics?**
- A. fungi - usually saprotrophic
B. animalia- rarely ingestive
C. protista - various modes of nutrition
D. plantae - photosynthetic

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3. The kingdom to which the algae belongs is _____.
A. monera B. protista
C. plantae D. fungi
4. Scientific name has advantages of _____.
A. same name applied to different organisms.
B. same organisms have different name in different areas.
C. has no scientific basis.
D. has scientific basis and universally accepted.
5. Binomial nomenclature was introduced by _____.
A. Aristotle B. Carolus Linnaeus
C. Ernest Haeckel D. R.H Whittaker
6. Which animal has not become extinct in Pakistan?
A. lion B. Asiatic cheetah
C. Marcopolo sheep D. Tiger
7. Who introduce three kingdoms of classification?
A. Aristotle B. Carolus Linnaeus
C. Ernest Haeckel D. R.H Whittaker
8. The organisms that feed on dead, decaying matter are called:
A. saprotrophs B. autotrophs
C. heterotrophs D. parasites
9. In Pakistan these are mostly found in the Khunjerab National Park and adjoining areas _____.
A. lion B. Asiatic cheetah
C. Marcopolo sheep D. Tiger
10. Viruses are assigned to the kingdom _____.
A. Monera B. Protista
C. Fungi
D. Not included in any kingdom

ANSWERS:

1. C	2. C	3. B	4. D	5. B
6. C	7. C	8. A	9. C	10. D

SHORT QUESTIONS

- Q1. Why are the following scientists famous for?
Aristotle, Abu Usman Umer Aljahiz.

Ans: Aristotle:

The two kingdom system was first proposed by Aristotle. The earliest known system of classification of organisms comes from the Greek philosopher Aristotle, who classified all living organisms known at that time as either in the group 'plants' or in 'animals'.

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Abu Usman Umer Aljahiz:

Al-Jahiz was a famous Muslim zoologist. He wrote books on theories of evolution, adaptation, animal psychology, migration of fishes and ants. **Abu-Usman Umer Aljahiz** described the characteristics of 350 species of animals in his book. He wrote a lot about the life of ants.

Q2. Compare two kingdom and five kingdom classification system.

Ans: Comparison of Classification System:

Two Kingdom Classification System	Five Kingdom Classification System
It includes two Kingdoms: Plantae and Animalia.	It includes five kingdoms: Monera, Protista, Fungi, Plantae and Animalia.
Bacteria and Cyanobacteria were placed in plant kingdom.	Bacteria and cyanobacteria are placed in kingdom Monera.
Unicellular or simple multicellular eukaryotes wrongly placed in kingdom Plantae and Animalia.	Unicellular or simple multicellular eukaryotes placed in kingdom Protista.
Fungi are wrongly placed in kingdom Plantae.	Fungi are placed in kingdom Fungi.

Q3. Can you differentiate between:

(a) Bacteria and Protists

(b) Fungi and Plants

(c) Plants and Animals

Ans: (a) Bacteria and Protists:

Bacteria	Protists
Bacteria are considered as unicellular prokaryotic organisms.	It include eukaryotic organisms with a unicellular or simple multicellular structure.
Mode of nutrition of bacteria is autotrophic or heterotrophic.	Protists is photosynthetic or heterotrophic or combination of both.
Bacterial cells vary in shape and occur single, in chains, or in clumps. The main types of shapes exists in bacteria are cocci, bacilli, vibrios, and spirilla	Plant like protists called algae e.g., Euglena. Fungi like protists e.g., slime molds. Amoeba.

(b) Fungi and Plants:

Fungi	Plants
Fungi are eukaryotic organisms. Mostly fungi are multicellular.	Plants are eukaryotic multicellular.
They have chitin in their cell wall.	Their cell wall is made up of cellulose.
Fungi may be saprotrophic decomposers.	Plants are autotrophic with chloroplasts containing chlorophyll.
The examples of fungi are black bread mold, yeast, mushroom, etc.	e.g., moss, mustard.

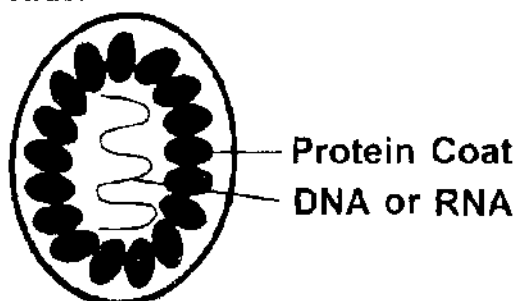
BIOLOGY NOTES FOR 9TH CLASS

(c) Plants and Animals:

Plants	Animals
Plants are eukaryotic multicellular.	Animals are multicellular eukaryotes.
Their cell wall is made up of cellulose.	Animals lack cell wall and chlorophyll.
Plants are autotrophic with chloroplasts containing chlorophyll.	Animals have heterotrophic mode of nutrition.
e.g., moss, mustard.	This kingdom includes invertebrates e.g., insects, star fish and vertebrates e.g., fish, frogs.

Q4. Draw and label a virus.

Ans: Structure of Virus:



Q5. Why are viruses regarded as acellular?

Ans: Virus:

Viruses are acellular, meaning they are biological entities that do not have a cellular structure. They therefore lack most of the components of cells, such as organelles, ribosomes, and the plasma membrane. Viruses are sometimes called virions: a virion is a 'complete' virus free in the environment (not in a host).

Viruses are acellular structures and are not included in the five kingdom classification system. Viruses are particles that lack structural characteristics of cells. They cannot carry out metabolic activities independently. Viruses are on the borderline between living and non-living world. The study of virus is known as virology.

Q6. Why viruses are considered at the borderline of living and non-living organisms?

Ans: Status of Viruses:

Viruses are at the borderline of living and nonliving. Due to their crystalline nature, they are considered as non-living. They are acellular i.e. they do not have cellular organization yet show some characters of living organisms (e.g. they possess DNA). Viruses contain either RNA or DNA, normally encased in protein coat. They reproduce only in living cells, where they cause a number of diseases. They are not considered as organisms and thus are not included in the five-kingdom classification.

OR

(Second Answer)

Viruses are considered at the borderline of living and non-living because they show both the characteristics of a living and a non-living. As they react like

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non-living in the free atmosphere but when they enter the body of a living organism then they show the features of a living organism and start reproduction. Some special features of being a living are that DNA and RNA codes are present in them. Some special features of being non-living are that they do some functions like excretion and can't multiply by own.

Q7. Write the importance of Binomial nomenclature.

Ans: Importance of Binomial Nomenclature:

Binomial nomenclature is the method of giving scientific names to living organisms. As the word "binomial" suggests, the scientific name of a species consists of two names: the first is genus name and the second one is the name of species.

In biological research, common names cause many problems. Different regions have different names for the same organism.

Binomial Nomenclature is important because it allows people from all over the world to easily study about the various plant and animal species. Also, it makes sure that every scientific name is unique.

Example: Brinjal is Baigun in Urdu, Bataoon in Punjabi, Vagton in Sindhi. Its biological name is *Solanum melangena*. Find out the Punjabi, Sindhi, Pushto or other local names or German, French, Spanish, Arabic, Russian, Chinese names of the following which will show the importance of biological name.

- i. **Potato** - *Solanum tuberosum*
- ii. **Rice** - *Oryza sativa*

A scientific name has the advantage of standing for a single kind of animal, plant or microorganism all over the world.

Q8. Why should we be concerned with preserving biodiversity?

Ans: Biodiversity boosts ecosystem productivity where each species, no matter how small, all have an important role to play.

The protection and preservation of all the natural resources needed for the existence and maintenance of life on earth is called conservation of biodiversity. We must protect all those things, which affect directly or indirectly the life on earth. Conservation biology brings together people and knowledge from many different fields to attempt to solve biodiversity crisis.

Conservation biology tries to understand the effects of human activities on ecosystems and develop practical approaches to prevent the extinction of species and the destruction of ecosystems.

OR

(Second Answer)

Biodiversity is the key indicator of the health of an ecosystem. A wide variety of species will cope better with threats than a limited number of them in large populations. Even if certain species are affected by pollution, climate change or human activities, the ecosystem as a whole may adapt and survive.

Biodiversity boosts ecosystem productivity where each species, no matter how small, all have an important role to play.

For example,

- A larger number of plant species means a greater variety of crops
- Greater species diversity ensures natural sustainability for all life forms.

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- Healthy ecosystems can better withstand and recover from a variety of disasters.
And so, while we dominate this planet (Earth), we still need to preserve the diversity in wildlife.

EXTENSIVE QUESTIONS

Q1. What is biodiversity? Write the importance of biodiversity in the natural ecosystem.

Ans: Biodiversity: Biodiversity is the variety of the living organisms present in an ecosystem. Biodiversity is the richness and variety of living organisms on Earth.

Importance of Biodiversity in the Natural Ecosystem:

The benefits and services provided by natural biodiversity include:

- Maintenance of soil quality:**
The activities of microbial and animal species play a key role in the cycling of crucial elements such as nitrogen, carbon and phosphorous between the living and non-living parts of the biosphere.
- Maintenance of air quality:**
Plant species purify the air and regulate the composition of the atmosphere.
- Maintenance of water quality:**
Wetland ecosystems (swamps, marshes, etc.) absorb and recycle essential nutrients, treat sewage, and cleans wastes.
- Pest control:**
Around 99 percent of potential crop pests are controlled by a variety of other organisms, including insects, birds and fungi.
- Pollination and crop production:**
Many flowering plants rely on the activities of various animal species - bees, butterflies, bats, birds, etc. - to help pollination. More than one-third of human's food crops depend on this process of natural pollination and dispersal of seeds.
- Provision of food and medicine:**
Biodiversity provides the majority of our foodstuffs and traditional medicines derived mainly from plants.

Q2. Describe classification? How can you classify organisms?

Ans: Classification:

Biologists have devised ways of grouping organisms. The grouping of organisms is called classification.

Taxonomy:

Taxonomy is called the science of classification. It is the branch of biology concerned with identification and naming of organisms.

Systematic:

The scientific study of diversity of organisms and their evolutionary relationship is called systematic.

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Aims and principles of classification:

The main aims and objectives of classification are:

- i. To determine similarities and differences between organisms.
- ii. To arrange organisms on the basis of similarities and differences.
- iii. Identify the organisms to study them systematically.
- iv. To find out evolutionary relationships among organisms.

Basis of Classification of Living Organisms:

The classification of organisms is based on the similarities in them. Similarities and differences are studied in the internal as well as external features.

Classification is based on relationship amongst organisms and such relationship is got through similarities in characteristics. These similarities suggest that all organisms are related to one another at some point in their evolutionary histories. However, some organisms are more closely related than others.

For example; sparrows are more closely related to pigeons than to insects. It means that the former two have common evolutionary histories.

When biologists classify organisms into groups and subgroups, the similarities are seen in external and internal structures and stages of development. Modern genetics provides another type of information to taxonomists. The similarities and differences in the DNA of two studied organisms can be used for getting idea about similarities and differences in their structures and functions.

Q3. Give an account of history of classification system.

Ans: History of Classification:

Many system of classification have been devised. Whenever any new information becomes available, it is incorporated. Living organisms have been classified into two to five kingdoms.

i. Two Kingdom system of classification:

The two kingdom system was first proposed Aristotle. The two kingdoms are kingdom Plantae (plants) and Kingdom Animalia (animals). Plants have cell wall and can make their own food, while animals cannot make food in their body.

ii. Three Kingdom system of classification:

A German scientist, Ernst Haeckel, proposed adding a third kingdom Protista in order to separate unicellular microscopic organisms from multicellular ones.

iii. Five Kingdom system of classification:

Five kingdom system of classification better explains diversity of living organisms. In the five kingdom system, the Monera are distinguished by their prokaryotic structure. The kingdom Protista contains a diverse group of unicellular organisms that are hard to classify and define. The five kingdom classification system places fungi in a separate kingdom.

Greek Period:

The earliest known system of classification of organisms comes from the Greek philosopher Aristotle, who classified all living organisms known at that time as either in the group 'plants' or in 'animals'.

Muslim Period:

In 700's Abu-Usman Umer Aljahiz described the characteristics of 350 species of animals in his book. He wrote a lot about the life of ants. In 1172 Ibn Rushd (Averroes), translated Aristotle's book "de Anima (On the Soul)" in Arabic. In the end of 15th century, many biologists had started work on classification methods e.g.

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Modern Period:

Andrea Caesalpino (1519-1603 AD)	Divided plants into fifteen groups and called them "genera".
John Ray (1627-1705 AD)	Published important works on plants' classification.
Augustus Rivinus (1652-1723 AD)	Introduced the taxon of "order".
Tournefort (1656-1708 AD)	Introduced the taxa of "class" and "species".
Carolus Linnaeus (1707-1778 AD)	Grouped species according to similar physical characteristics. Carolus Linnaeus divided nature into three kingdoms: mineral, vegetable and animal. Linnaeus used five ranks in classification: class, order, genus, species, and variety. Linnaeus is best known for his introduction of the method still used to formulate the scientific name of every species.

Biologists prefer such a system that can provide maximum information about the basic differences and similarities among different organisms. According to earlier classification system, organisms were classified into two kingdoms but now taxonomists agree on five-kingdom classification system

Q4. Describe the diagnostic characteristics of the five kingdoms.

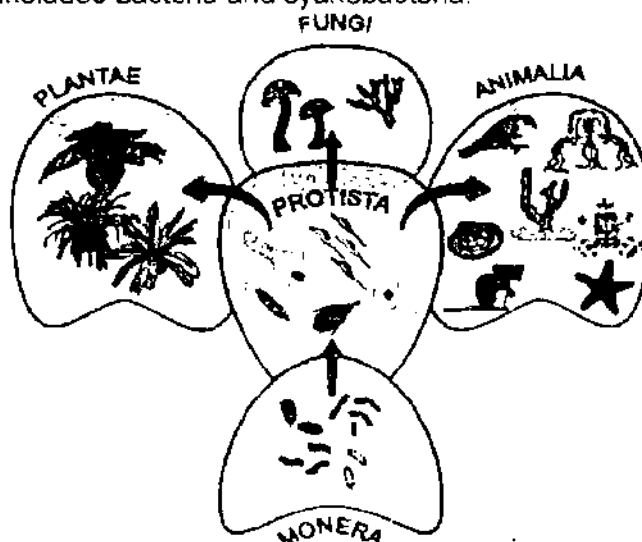
Ans: Diagnostic characteristics of the Five Kingdoms:

At present the organisms have been divided into five kingdoms:

Monera, Protista, Fungi, Plantae and Animalia.

i. **Monera:**

All prokaryotic organisms are included in kingdom Monera. They are unicellular, filamentous or colonial and are relatively simple in structure. This kingdom includes bacteria and cyanobacteria.



Five Kingdoms of Classification

BIOLOGY NOTES FOR 9TH CLASS

ii. **Protista:**

These include eukaryotic organisms with a unicellular or simple multicellular structure. These are mostly aquatic. It is a diverse group of organisms. It includes: Animal like protist called protozoa e.g., Amoeba. Plant like protists called algae e.g., Euglena. Fungi like protists e.g., slime molds.

iii. **Fungi:**

Fungi are eukaryotic organisms which have chitin in their cell wall. Fungi may be saprotrophic decomposers. Mostly fungi are multicellular. Some fungi are unicellular. The examples of fungi are black bread mold, yeast, mushroom, etc.

iv. **Plantae:**

The members of kingdom plantae are eukaryotic multicellular and autotrophic with chloroplasts containing chlorophyll. Their cell wall is made up of cellulose e.g., moss, mustard.

v. **Animalia:**

Animals are multicellular heterotrophic eukaryotes. Animals lack cell wall and chlorophyll. They can generally move from place to place. This kingdom includes invertebrates e.g., insects, star fish and vertebrates e.g., fish, frogs.

Distinguishing characteristics of the five kingdoms of life:

Kingdom	Cell Type	Nuclear Envelope	Cell Wall	Mode of Nutrition	Multi-Cellularity
Monera	Prokaryotic	Absent	Non-cellulose (polysaccharide plus amino acids)	Autotrophic or heterotrophic	Absent
Protista	Eukaryotic	Present	Present in some forms, various types	Photosynthetic or heterotrophic, or combination	Absent in most forms
Fungi	Eukaryotic	Present	Chitin	Absorptive heterotroph	Present in most forms
Plantae	Eukaryotic	Present	Cellulose and other polysaccharides	Photosynthetic	Present in all forms
Animalia	Eukaryotic	Present	Absent	Ingestive heterotroph	Present in all forms

Q5. What is Binomial nomenclature? Describe aims, principles and importance of Binomial nomenclature using local examples.

Ans: Binomial Nomenclature:

Binomial nomenclature is the method of giving scientific names to living organisms. As the word "binomial" suggests, the scientific name of a species consists of two names: the first is genus name and the second one is the name of species.

Linnaeus introduced a naming system to give each organism a name consisting of two Latin names. The first name is genus and the second name represents the particular species.

The genus name begins with a capital letter; the species name begins with a small letter. Since each name has two parts so it is called binomial nomenclature.

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Example:

Biological name of human beings is *Homo sapiens*. Our genus name is *Homo* and species name is *sapiens*. A genus may have many species e.g., all cats belong to genus *Felis* including lion.

Aims / Significance of Binomial Nomenclature:

In biological research, common names cause many problems. Different regions have different names for the same organism.

For example; common name of onion in Urdu is 'Piyaz' but in different regions of Pakistan it is also known as 'ganda' or 'bassal' or 'vassal'. In other countries, it has other sets of names. In science, it is known with a single name as *Allium cepa*.

In some cases, different organisms are called by the same common name.

For example; the name 'black bird' is used for crow as well as for raven.

Common names have no scientific basis.

For example; a fish is a vertebrate animal with fins and gills. But several common names of 'silver fish', 'cray fish', 'jelly fish', and 'star fish' do not fit the biologist's definition of a fish.

To avoid all these confusions, organisms are given scientific names by using binomial nomenclature. The value of this system is due to its widespread use and the stability of its names. In binomial nomenclature, every species can be unambiguously identified with just two words. Same name can be used all over the world, in all languages, avoiding difficulties of translation.

Common Name	Scientific Name
Onion	<i>Allium cepa</i>
Amaltas	<i>Cassia fistula</i>
Potato	<i>Solanum tuberosum</i>
Tomato	<i>Lycopersicum esculentum</i>
Man	<i>Homo sapiens</i>

Principles of Binomial Nomenclature:

- Scientific names are usually printed in italics, such as *Homo sapiens*. When handwritten they are underlined.
- The first term (generic name) always begins with capital letter, while the species name is never capitalized (even when derived from a proper name).
- The scientific name is generally written in full when it is first used. But when several species from the same genus are being listed, it may then be abbreviated by just using an initial for genus; for example *Escherichia coli* becomes *E. coli*.

Importance of Binomial Nomenclature:

A common name will vary from country to country just because different countries use different languages. Hence there was a need for a universal language such as Latin. Even those who speak the same language sometime use different common name for the same organisms.

Example:

Brinjal is Baigun in Urdu, Bataoon in Punjabi, Vagton in Sindhi. Its biological name is *Solanum melangena*. Find out the Punjabi, Sindhi, Pushto or other local

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names or German, French, Spanish, Arabic, Russian, Chinese names of the following which will show the importance of biological name.

- i. **Potato** - *Solanum tuberosum*
- ii. **Rice** - *Oryza sativa*

A scientific name has the advantage of standing for a single kind of animal, plant or microorganism all over the world.

Q6. What is the conservation of biodiversity? Explain impact of human beings on biodiversity.

Ans: Conservation of biodiversity:

The protection and preservation of all the natural resources needed for the existence and maintenance of life on earth is called conservation. So, we must protect all those things, which affect directly or indirectly the life on earth.

Conservation of biology:

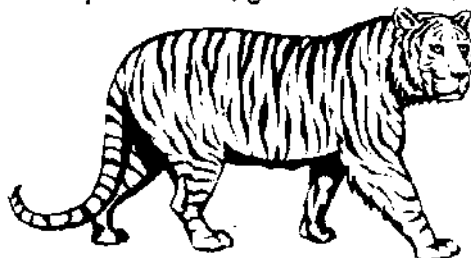
Conservation biology brings together people and knowledge from many different fields to attempt to solve biodiversity crisis. Conservation biology tries to understand the effects of human activities on ecosystems and develop practical approaches to prevent the extinction of species and the destruction of ecosystems.

Extinct species / Endangered species:

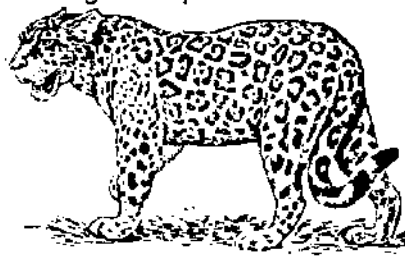
A species of plant or animal that no longer lives anywhere on Earth is said to be extinct. Many living organisms are in danger of becoming extinct. These species of plants and animals are called endangered species.

Examples of Extinct species / Endangered species:

The Bengal tiger, panda, etc., are some examples of endangered species. Snow leopard falcon, green turtle etc., are the endangered species of Pakistan.



Bengal Tiger



Snow leopard



Mountain Gorilla



Panda

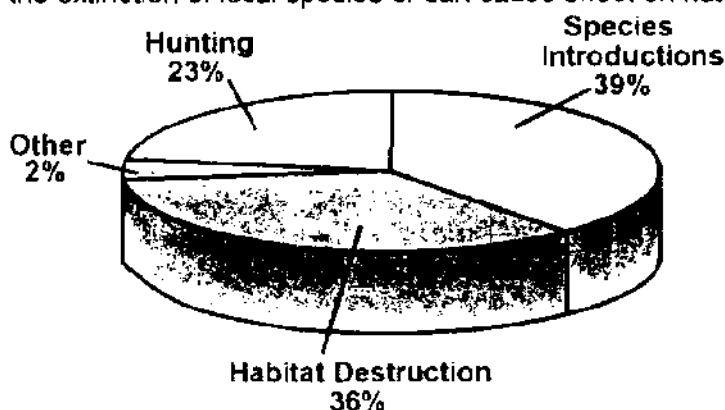
Endangered species

BIOLOGY NOTES FOR 9TH CLASS

Impact of human beings on biodiversity:

Human Impact on Biodiversity:

- i. **Hunting:** Hunting has increased the rate of extinction by killing the organisms. Wild plants and animals are called wild life. One way that people threaten wildlife is by damaging or destroying their habitat. Forests and grassland are being cleared for new roads, farms, cities and also other human activities like mining and building of dams, destroy habitats. The accidental or purposeful introduction of new species into an ecosystem can cause the extinction of local species or can cause effect on nature.



Known causes of species extinctions

- ii. **Pollution:** Pollution also affects environment and biodiversity. The global climate change may occur so rapidly that many species will be unable to adjust their range and may become extinct. Pesticides have caused the abundance of predatory birds to decrease and acid deposition has caused worldwide decline in amphibian population.
- iii. **Deforestation:** The cutting down of trees, destruction of forest, leaves the soil barren, which is called deforestation.
We are destroying forests:
- (a) for timber
 - (b) to get land for agriculture
 - (c) to make roads, airports etc
 - (d) to make houses, buildings for the settlement of ever-increasing number of human population and urban development.
 - (e) to get land for grazing.



Chopping trees in Pakistan

BIOLOGY NOTES FOR 9TH CLASS

Q7. Identify causes of deforestation and its effects on biodiversity with examples.

Ans: Deforestation:

Deforestation means cutting down of trees for the conversion of a forest to non-forest land. The destruction of significant areas of forest has resulted in a degraded environment with reduced biodiversity.

Causes of Deforestation:

Removal of forests causes soil erosion, silting up of lakes and rivers, flood and the loss of thousands of species of animals and plants. Trees can grow on hillsides even when the soil layer is quite thin. When the trees are cut down and the soil is ploughed, there is less protection from the wind and rain. Heavy rainfall washes the soil off the hillsides into rivers.

Example:

The hillsides are left bare and useless and the rivers become choked up with mud and silt, which can cause floods. Sedimentation has halved the lives of reservoirs e.g., Tarbella Dam, Mangla Dam etc., hydroelectric schemes and irrigation program.

Effects of Deforestation on Biodiversity:

Deforestation affects the amount of water in soil and moisture in atmosphere. When there are no trees to keep soil in place, there are more chances of soil erosion. Heavy rainfall washes soil into rivers.

Essential nutrients are washed out of soil. Rivers become choked up with mud and silt, which can cause floods. The silted water gets stored in dams and it reduces their water storage capacity. Deforestation also contributes to decreased transpiration, which lessens cloud formation. This ultimately reduces the sources of rains. Forests extract carbon dioxide and pollutants from the air, thus contributing to biosphere stability.

Transpiration:

About half of the rain, comes from the transpiration of the trees themselves. The clouds which are formed from this transpired water help to reflect sunlight and keep the region relatively cool and humid. When areas of forest are cleared, this source of rain is removed, cloud cover is reduced and the local climate change quite dramatically. The temperature range from day to night is more extreme and the rainfall reduces. Many of our present-day drugs quinine, aspirin etc., are derived from plants. We are likely to deprive the world of these valuable resources. In Pakistan, deforestation is a great threat to biodiversity.

Q8. Discuss issues of conservation of biodiversity in Pakistan with reference to deforestation and hunting.

Ans: Issues of Conservation of Biodiversity in Pakistan:

The issues of conservation of biodiversity in Pakistan are deforestation and hunting.

Deforestation: Pakistan is facing a real deforestation crisis as a very large area of forest is being used either for fuel purpose or for wood furnishing in the country.

Causes and effects of deforestation on biodiversity:

Sometime there is slow forest degradation and sometime sudden and catastrophic clear-cutting for urban development. Deforestation can be the result of deliberate removal of forests for wood, agriculture or urban development.

BIOLOGY NOTES FOR 9TH CLASS

Deforestation affects the amount of water in soil and moisture in atmosphere. When there are no trees to keep soil in place, there are more chances of soil erosion. Heavy rainfall washes soil into rivers

Essential nutrients are washed out of soil. Rivers become choked up with mud and silt, which can cause floods. The silted water gets stored in dams and it reduces their water storage capacity. Deforestation also contributes to decreased transpiration, which lessens cloud formation. This ultimately reduces the sources of rains.

Causes and effects of hunting on biodiversity:

Hunting:

Hunting is a threat to animals in Pakistan. So, hunting of some animals and birds is completely banned e.g., black deer, spotted deer etc. Hunting of some animals is allowed only in particular seasons. Still there is threat to wildlife in Pakistan.

Extinct and endangered animals in Pakistan:

Cheetah, Tiger, Asian Lion etc., have been declared extinct. While Indus dolphin, Blackbuck, Snow leopard etc., have been declared as endangered species in Pakistan. Population growth is also an issue of conserving biodiversity. The conservation strategies adopted by government of Pakistan for checking deforestation and hunting are:

- (a) There is department of forestry having forest officer and forest guards. They check the unauthorized cutting of trees. e.g., nobody is allowed to cut trees in the Capital territory of Islamabad. Those who cut trees or jungle anywhere in Pakistan are arrested and prosecuted as per law.
- (b) Hunting of endangered species is prohibited. Hunting of birds is not allowed during their breeding seasons.

Few endangered species in Pakistan:

i. Houbara Bustard:

The houbara bustard is a large bird. It is hunted for its meat; widespread hunting has almost put it on the endangered list

ii. Indus Dolphin:

The Indus dolphin is blind so it uses sonar waves (like bats) to find its way in the muddy water of river. The Indus river dolphin is found in the river Indus of Pakistan. It is now seriously threatened in its only habitat. With the construction of dams along the river Indus today the species is only found between Jinnah and Koth barrages.

iii. Marco Polo Sheep:

Marco Polo sheep, in Pakistan, are mostly found in the Khunjerab National Park and adjoining areas. These are endangered and their numbers have been rapidly decreasing in the last two decades.

BIOLOGY NOTES FOR 9TH CLASS

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Houbara bustard



Indus Dolphin



Marco polo sheep

Endangered species in Pakistan

Q9. What is the possible connection between cutting down trees on hillsides and flooding in the valleys?

Ans: Erosion is a natural process, but human activity can make it happen more quickly. Human activity altering the vegetation of an area is perhaps the biggest human **factor** contributing to erosion. Trees and plants hold soil in place. When people cut down forests or plow up grasses for agriculture and development, the soil is more vulnerable to washing or blowing away. Landslides become more common. Water **rushes** over exposed soil rather than soaking into it, causing flooding.

When deforestation takes place, the top layer of soil can be dislodged – this is also known as soil erosion. When the top layer of soil is unstable, it is unable to retain any of the water that falls on it, resulting in increased surface run-off, which, in turn, increases the risk of flooding.

Increases in deforestation can result in increased flooding and therefore expansion of wetlands or floodplains. Water in wetlands then cuts off the oxygen supply to the soil. This results in anaerobic fermentation, which forms large amounts of methane, a greenhouse gas from the flooded forests.

Deforestation affects the amount of water in soil and moisture in atmosphere. When there are no trees to keep soil in place, there are more chances of soil erosion. Heavy rainfall washes soil into rivers.

Essential nutrients are washed out of soil. Rivers become choked up with mud and silt, which can cause floods. The silted water gets stored in dams and it reduces their water storage capacity.

THE TERMS TO KNOW

1. **Acellular:** The organisms / structures that do not have cell organization e.g. viruses, viroids and prions
2. **Animalia:** The kingdom that includes multicellular heterotrophs that ingest food and digest it in body parts.
3. **Binomial nomenclature:** The system of naming organisms, in which the name consists of two words i.e. generic name and species name.

BIOLOGY NOTES FOR 9TH CLASS

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4. **Biodiversity:** The variety of species present in an ecosystem and the variety of organisms in each species.
 5. **Class:** A taxon that contains related orders.
 6. **Classification:** The grouping of organism on the basis of similarities found in them.
 7. **Conservation:** Defining the endangered and threatened species and taking measures for their protection.
 8. **Deforestation:** Cutting down trees and converting forest into non-forest area.
 9. **Endangered species:** The species that is at risk of becoming extinct because few members are left.
 10. **Fungi:** Eukaryotic heterotrophs that absorb food and contain chitin in their cell walls.
 11. **Monera:** The kingdom that includes prokaryotes.
 12. **Plantae:** The kingdom of multicellular eukaryotic autotrophs.
 13. **Prion:** The acellular particles that consists of protein only.
 14. **Protista:** The kingdom containing the unicellular, colonial or simple multicellular eukaryotes.
 15. **Soil erosion:** Loss of topsoil often resulting from deforestation and wind or water erosion.
 16. **Species:** A group of similar organisms which can naturally interbreed among themselves to produce fertile offspring.
 17. **Systematics:** The branch that deals with the classification and evolutionary histories of organisms.
 18. **Taxonomic hierarchy:** The arrangement of taxonomic taxa.
 19. **Viroid:** The acellular particles that consists of circular RNA Only.

MULTIPLE CHOICE QUESTIONS

1. **Classification means the grouping of organisms on the basis of;**
A. How they feed
B. The features they have in common
C. How they respire
D. How they can survive
2. **The kingdom Protista includes;**
A. Unicellular and simple multicellular organisms with prominent nucleus
B. True multicellular organisms with no prominent nucleus
C. True multicellular organisms prominent nucleus
D. Unicellular organisms with no prominent nucleus
3. **Viruses are not classified in any kingdom because;**
A. They are too poorly understood
B. They are too small
C. Their genetics cannot be determined
D. They are not considered organisms

BIOLOGY NOTES FOR 9TH CLASS

- =====
4. **Viruses are assigned to the kingdom;**
 - A. Monera
 - B. Protista
 - C. Fungi
 - D. None of the above
 5. **A related group of genera comprises;**
 - A. An order
 - B. A family
 - C. Class
 - D. A phylum
 6. **In which kingdom would you classify unicellular eukaryotes?**
 - A. Fungi and protists
 - B. Fungi and monera
 - C. Only protista
 - D. Only Fungi
 7. **In binomial nomenclature, the first letter of the _____ name is capitalized.**
 - A. Family
 - B. Class
 - C. Species
 - D. Genus
 8. **Which one of the following sequences shows the correct hierarchy of classification, going from the smaller to the bigger group?**
 - A. Kingdom, Phylum, Order, Class, Family, Genus, Species
 - B. Kingdom, Phylum, Class, Order, Family, Genus, Species
 - C. Genus, Species, Kingdom, Phylum, Order, Class, Family
 - D. Species, Genus, Family, Class, Order, Phylum, Kingdom
 9. **Which of the following may be the correct way of writing the scientific name of an organism?**
 - A. *Canis lupis*
 - B. Saccharum
 - C. Grant's gazelle
 - D. E.Coli
 10. **A certain organism is multicellular, adapted for photosynthesis, and has multicellular sex organs. To which kingdom does it belong?**
 - A. Animalia
 - B. Fungi
 - C. Plantae
 - D. Protista
 11. **Species that are in the same _____ are more closely related than,**
 - A. Phylum ... class
 - B. Family ... order
 - C. Class ... order
 - D. Family ... genus
 12. **When the last member of a particular species dies, the species is said to be _____.**
 - A. Established
 - B. Extinct
 - C. Threatened
 - D. Endangered
 13. **In which season *Houbara bustard* migrates to Pakistan and settles here?**
 - A. Summer
 - B. Spring
 - C. Autumn
 - D. Winter

ANSWERS:

1. B	2. A	3. D	4. D	5. B
6. C	7. D	8. D	9. A	10. C
11. B	12. B	13. D		

BIOLOGY NOTES FOR 9TH CLASS

MULTIPLE CHOICE QUESTIONS

1. **What is the difference between a vulnerable species and an endangered species?**
 - A. A vulnerable species is likely to become endangered. An endangered species is likely to become extinct.
 - B. A vulnerable species and an endangered species are the same thing.
 - C. A vulnerable species is likely to become extinct. An endangered species is likely to become endangered.
 - D. Both species have gone extinct.
2. **Which sense does the Indus Dolphin use to find its prey?**
 - A. Vision
 - B. Hearing
 - C. Smell
 - D. Touch
3. **The kingdom that includes multicellular heterotrophs that ingest food and digest it in body parts belongs to:**
 - A. Species
 - B. Plantae
 - C. Protista
 - D. Animalia
4. **The moneras that evolved first and live in extreme habitats is called.**
 - A. Archaeobacteria
 - B. Saccharum
 - C. Canis Lupis
 - D. E.Coli
5. **The variety of species present in an ecosystem and the variety of organisms in each species belongs to**
 - A. Ecosystem
 - B. Habitat
 - C. Biodiversity
 - D. Biotic factors
6. **Defining the endangered and threatened species and taking measures for their protection is _____.**
 - A. Extinct
 - B. Conservation
 - C. Established
 - D. Vulnerable
7. **Gutting down trees and converting forest into non-forest area is called:**
 - A. Genus
 - B. Vulnerable
 - C. Protista
 - D. Deforestation
8. **The monerans that evolved after the archaeobacteria:**
 - A. Saccharum
 - B. Eubacteria
 - C. Canis Lupis
 - D. E.Coli
9. **An organism that contain eukaryotic cells:**
 - A. Protista
 - B. Eukaryote
 - C. Plantae
 - D. Taxon
10. **Eukaryotic heterotrophs that absorb food and contain chitin in their cell walls:**
 - A. Plantae
 - B. Protista
 - C. Fungi
 - D. Genus

BIOLOGY NOTES FOR 9TH CLASS

- =====
11. The kingdom that includes prokaryotes:
 A. Monera B. Fungi
 C. Protista D. Plantae
 12. In evolutionary tree, the group of descendants having the same ancestor:
 A. Diphyletic B. Phylum
 C. Monophyletic D. Order
 13. The kingdom of multicellular eukaryotic autotrophs:
 A. Protista B. Plantae
 C. Fungi D. Monera
 14. The acelluar particles that consists of protein only:
 A. Prion B. Viroid
 C. Coli D. Taxon
 15. The kingdom containing the unicellular, colonial or simple multicellular eukaryotes:
 A. Fungi B. Plantae
 C. Protista D. Animalia
 16. A group of similar organisms which can naturally interbreed among themselves to produce fertile offspring:
 A. Family B. Species
 C. Genus D. Class
 17. The species that is at the risk of becoming extinct in near future:
 A. Threatened species B. Extinct
 C. Endagered D. Established
 18. The acelluar particles that consists of circular RNA only.
 A. Viroid B. E.Coli
 C. Prion D. Taxon

ANSWERS:

1. A	2. B	3. D	4. A	5. C
6. B	7. D	8. B	9. B	10. C
11. A	12. C	13. B	14. A	15. C
16. B	17. A	18. A		

BIOLOGY NOTES FOR 9TH CLASS

UNIT-04

CELLS AND TISSUES

CHAPTER WISE NOTES

Q1. Briefly state the function of Microscope.

Ans: The most basic tool of biologist is the microscope. An instrument used to see small things is called **microscope**, and the use of microscope is called **microscopy**. Microscope increases the magnification and resolution of the object. The first compound microscope was developed by Zacharias Janssen (1595) in Holland.

Q2. Briefly explain the structure and function of Cell wall.

Ans: Structure of Cell Wall:

The cell wall surrounds the cell membrane. It consists of three main layers.

i. **Middle lamella:**

Middle lamella is present between adjacent primary walls of the two cells. It is formed of sticky gel like substance.

ii. **Primary cell wall:**

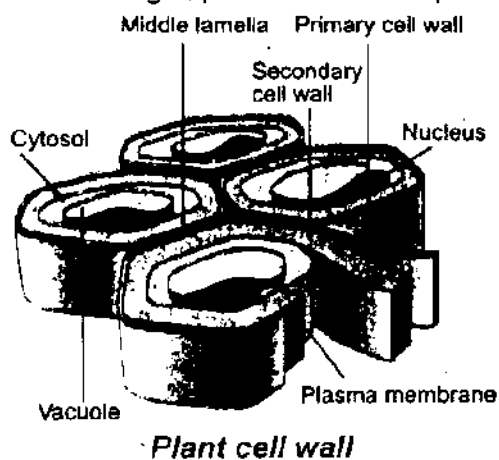
Primary cell wall is a true wall and develops in newly growing cells. It consists of cellulose and other compounds.

iii. **Secondary cell wall:**

Secondary cell wall is formed between the primary cell wall and the plasma membrane. It is formed in Woody tissues e.g., stem and nuts. It has lignin and cellulose.

Functions of cell wall:

The cell walls have minute pores forming living connection between the cells. The cell wall is non-living and allows water and dissolved substances to pass through. It gives mechanical strength, protection and shape to the cell.



BIOLOGY NOTES FOR 9TH CLASS

Q3. Highlight the specific features of Vacuoles.

Ans: Vacuoles:

A vacuole is a sac-like structure, bounded by a single membrane and is filled with watery fluid. Typically, mature plant cells have a large central vacuole. Vacuoles store substances.

Q4. What do you know about plastids? Elaborate different types of plastids.

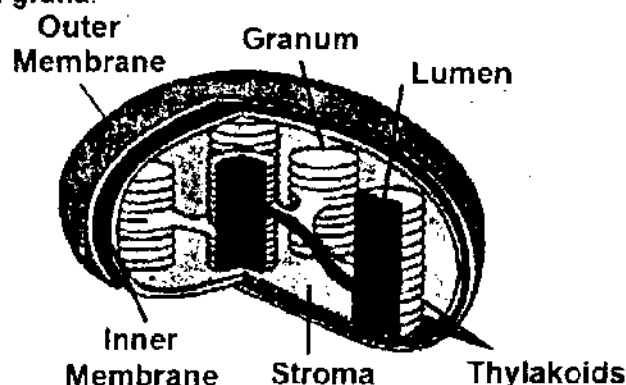
Ans: Plastids:

Plastids are membrane-bounded structures and contain different pigments.

Types of plastids:

There are three types of plastids: leucoplasts, chromoplasts and chloroplasts.

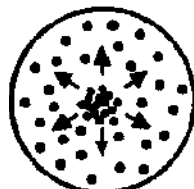
- i. **Leucoplasts:** Leucoplasts are colourless. These are found in the underground parts of the plant e.g., roots, tubers. Leucoplasts store food.
- ii. **Chromoplasts:** Chromoplasts have colours other than green, and are present in the petals of flowers and ripened fruits. Chromoplasts help the plant in pollination and dispersal of fruits.
- iii. **Chloroplasts:** Chloroplasts are green coloured and are located in the leaves. These are the sites of photosynthesis. It is bounded by a smooth double membrane. The fluid is called stroma. The inner membrane is folded to form hollow coin like structures called **thylakoid**. The stacks of thylakoids are called **grana**.



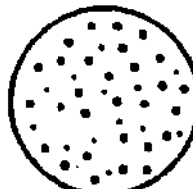
Q5. Highlight the Passage of moving molecules occur into and out of cells.

Ans: Molecules must pass into and out of the cell. This passage of molecules takes place through the cell membrane. Molecules of cells are dissolved in water, which provides a fluid environment within which the molecules can move.

Molecules of solute spread out in all directions



Solute molecules spread out evenly



Moving molecules

BIOLOGY NOTES FOR 9TH CLASS

Q6. State passive transport and its type.

Ans: Passive Transport - Movement that Does Not Require Energy:

In this type of movement, molecules move from regions of higher concentration to those of lower concentration i.e., down a concentration gradient without any expenditure of energy.

Types of Passive transport:

There are four types of passive transport:

- | | |
|--------------|---------------------------|
| i. diffusion | ii. facilitated diffusion |
| iii. osmosis | iv. filtration |

Q7. Define tonicity and enlist its type.

Ans: Tonicity:

The strength of a solution in relationship to osmosis is called tonicity.

Types of tonicity:

The solutions are of three types.

- Isotonic solution
- Hypotonic solution
- Hypertonic solution

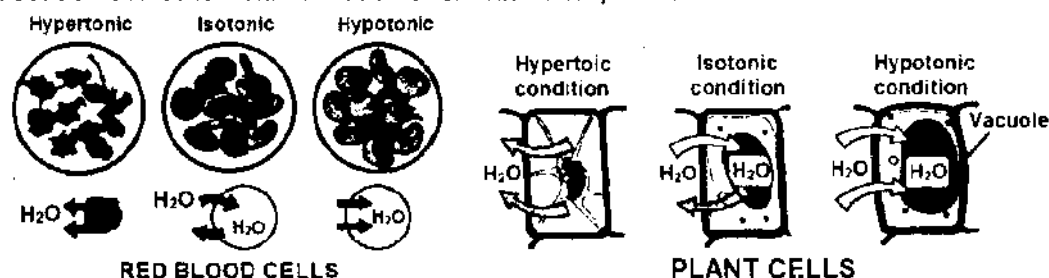
Q8. Explain isotonic solution with example.

Ans: Isotonic solution:

Cells are normally placed in solutions that cause them neither to gain nor loss water. Such a solution is called **isotonic solution**. That is the solute concentration is the same on both sides of the membrane and therefore there is no gain or loss of water.

Example:

A 0.9% solution of sodium chloride is known to be isotonic to red blood cells because the cells neither swell nor shrink when placed in this solution.



Q9. Explain hypotonic solution in detail. Also give an example.

Ans: Hypotonic solution:

Solutions that cause cells to swell or even burst due to an intake of water are said to be **hypotonic solution**.

Example:

A solution with a lower percentage of solute (more water) than the cell. If a cell is placed in a hypotonic solution, water enters the cell. the net movement of water is from the outside to the inside of the cell. Any concentration of salt solution lower than 0.9% is hypotonic to red blood cells. Red blood cells placed in such a solution expand and sometimes burst. The swelling of a plant cell in hypotonic solution creates turgor pressure.

BIOLOGY NOTES FOR 9TH CLASS

When a plant cell is placed in hypotonic solution the cytoplasm expands because the larger central vacuole gains water and plasma membrane pushes against the rigid cell wall.

The cell in this state becomes **turgid**. The plant cell does not burst because the cell wall does not give way.

Q10. Briefly explain hypertonic solutions with an example.

Ans: Hypertonic solutions:

Solutions that cause cells to shrink due to a loss of water are said to be **hypertonic solutions**.

A solution with higher percentage of solutes. In hypertonic solution, water leaves the cell; the net movement of water is from the inside to the outside of the cell.

Example:

A solution with a concentration higher than 0.9% sodium chloride is hypertonic to red blood cells. If red blood cells are placed in this solution, they shrink. If a plant cell is placed in a hypertonic medium, it loses water to its surroundings and its contents shrink away from the wall. The process is called **plasmolysis**.

Plasmolysis occurs in plants when the soil or water around them contains high concentration of salts or fertilizers.

Q11. Discuss the significance of filtration and its function.

Ans: The molecules are forced through membranes by the **hydrostatic pressure**, called **blood pressure**, which is greater on one side of the membrane than on the other. This process by which molecules are forced through membranes is called **filtration**.

In the body, **tissue fluid** is formed when water and dissolved substances are forced out through the thin, porous walls of blood capillaries, but; larger particles such as blood proteins molecules are left inside.

Q12. Briefly explain active transport with an example.

Ans: ACTIVE TRANSPORT - Movement that Does Require Energy:

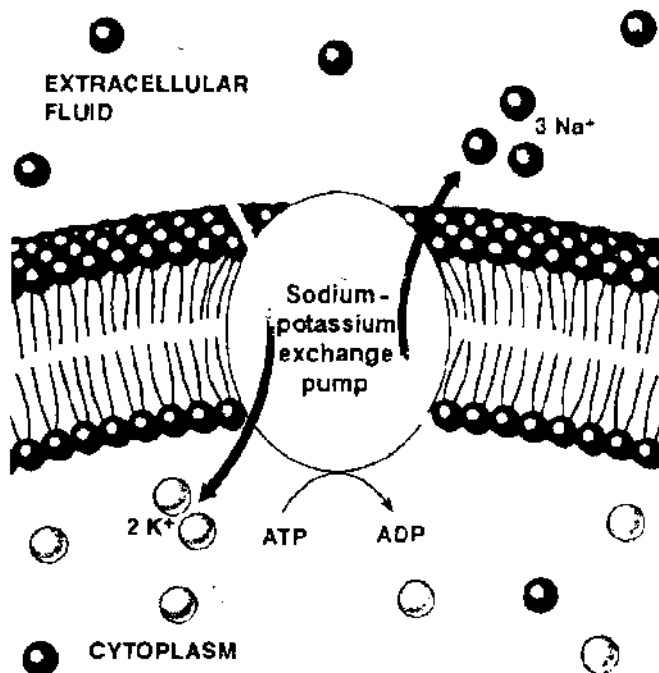
Sometimes substances move against a concentration gradient in the reverse direction to normal diffusion. Such movement is called **active transport**. This process requires energy in the form of ATP.

Active transport is involved in many processes. For example, uptake of dissolved mineral salts by the root hairs, absorption of glucose and amino acids by cells in the small intestine of humans.

The cell membranes of neuron have **sodium potassium pumps**. By activity of these pumps neuron maintain more sodium outside and more potassium inside. Such ionic distribution is necessary for proper working of neuron.

BIOLOGY NOTES FOR 9TH CLASS

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Sodium potassium pump

Q13. What are tissues?

Ans: Tissues:

Tissues are groups of cells that have a similar structure and act together to perform a specific function. The bodies of multicellular organisms are made up of different types of cells. Each type of cell is specialized to perform a particular biological function.

Q14. Describe the major animal tissues in terms of their cell specifications, location and functions?

Ans: Animal Tissues:

The group of cells having similar structure and performing a particular function in animals is called animal tissue.

Types / Groups of animal tissues:

Animal tissues are divided into four groups namely **epithelial tissue**, **connective tissue**, **muscular tissue** and **nervous tissue**.

I. **Epithelial Tissue:**

Epithelial tissue is also called **epithelium**. It consists of tightly packed cells that form a continuous layer or sheet covering the entire body surface and lining most of the inner cavities.

Types of Epithelium:

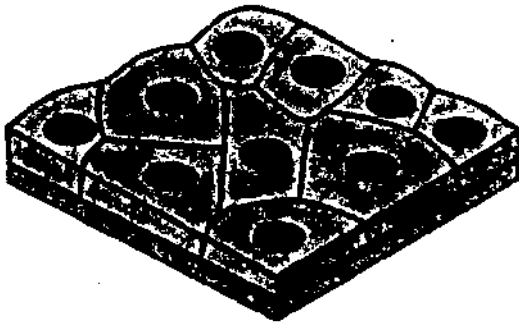
There are five types of epithelium.

a) **Squamous Epithelium:**

The cells are thin and flattened and arranged as a single layer. It is present in the alveoli of lungs, blood vessels etc. Its function is passage of material by diffusion and filtration.

BIOLOGY NOTES FOR 9TH CLASS

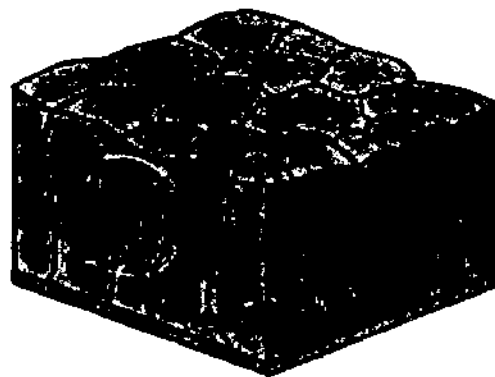
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Squamous epithelium



Cuboidal epithelium



Columnar epithelium

b) Cuboidal Epithelium:

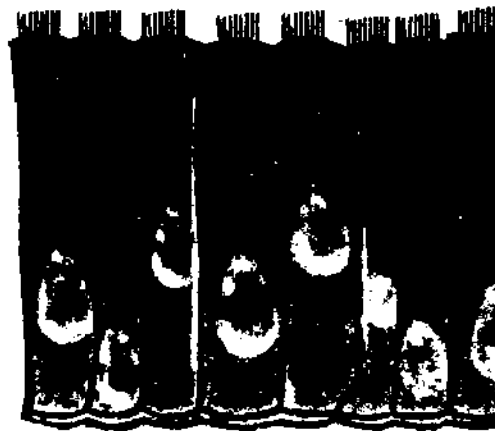
Cells are cube shaped, arranged in a single layer. They are present in tubules of kidney, and ducts of glands etc. Its function is secretion and absorption.

c) Columnar Epithelium:

These cells are long and narrow. Columnar epithelium lines stomach, intestine etc. Its function is secretion, absorption and protection.

d) Ciliated Epithelium:

Cells are columnar in shape but bear cilia at their free surfaces. These cells line the respiratory passages. It transports materials through tubes or passage ways.

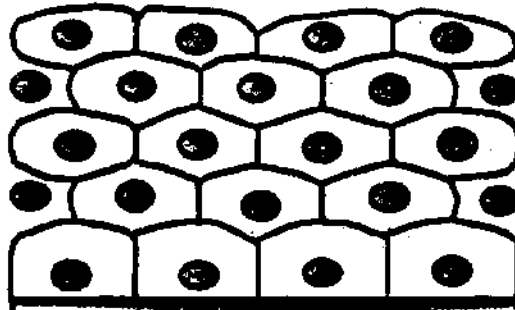


Ciliated Epithelium

BIOLOGY NOTES FOR 9TH CLASS

e) **Stratified Epithelium:**

This tissue is made up of a number of layers. It is present in oesophagus, skin etc. Its main function is protection.



Stratified Epithelium

ii. **Connective Tissue:**

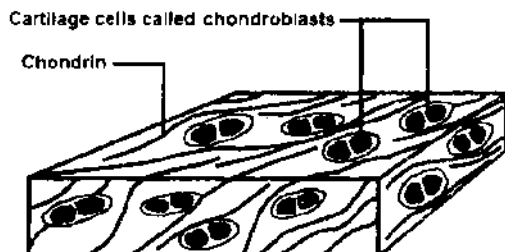
The connective tissue cells are widely separated by a **matrix**, which is found between the cells and consists of a noncellular material that varies from solid to semisolid to fluid. The matrix may have fibres.

Bone and cartilage are hard connective tissue which support body and help in movement. Tendons and ligaments are **fibrous connective tissues** which maintain skeletal structure.

Adipose tissue:

Adipose tissue is a fatty tissue which provides insulation and stores energy.

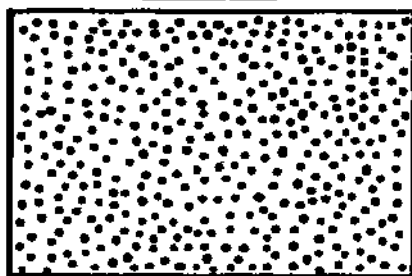
Blood is a fluid connective tissue which transports substances in the body.



Cartilage



Bone



Human blood cells



Adipose tissue

iii. **Muscular Tissue:**

Muscular tissue is composed of bundles of long cells called **muscle fibres**. These fibres are contractile, held together by connective tissue. Muscle fibres contain **actin filaments** and **myosin filaments**. The filaments cause the movement of the body and body parts.

BIOLOGY NOTES FOR 9TH CLASS

Types of muscular tissue:

All the vertebrates have three types of muscular tissue:

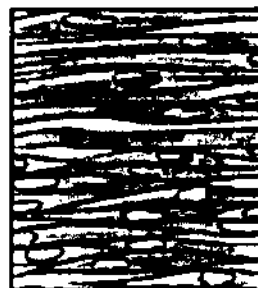
- (a) Skeletal muscle (b) Smooth muscle (c) Cardiac muscle



Nucleus

Striations

Skeletal muscle



Smooth
Muscle cell

Nucleus

Smooth muscle



Intercalated
disc

Nucleus

Cardiac muscle

a) **Skeletal Muscle:**

Skeletal muscle fibres are attached to the bones by tendons. It is also called **striated muscle**. It is responsible for the voluntary movements of the body. Skeletal muscles are multinucleated.

b) **Smooth Muscle:**

Each cell of smooth muscle is spindle shaped with a centrally located nucleus. It is called smooth muscle as it lacks striation. Smooth muscle is not under voluntary control so it is called **involuntary muscle**. It is found in the walls of intestine, stomach, urinary bladder, blood vessels and other internal organs.

c) **Cardiac Muscle:**

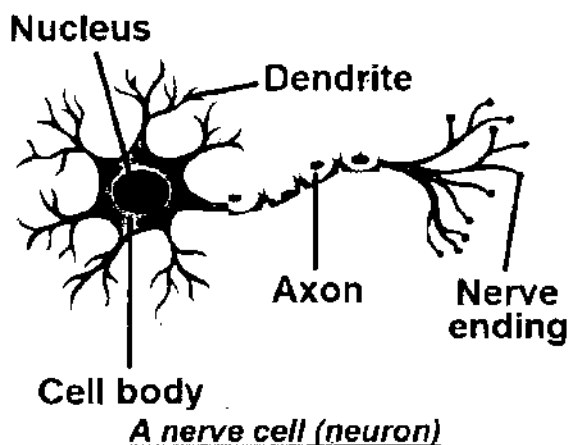
It is found only in the walls of the heart. It has striations like skeletal muscle, but the contraction of the cardiac muscle is involuntary. Cardiac muscle cells also differ from skeletal muscle cells in that they have single, centrally placed nucleus. The cells are branched and are bound end to end. Intercalated disc is the identifying feature of cardiac muscle.

iv. **Nervous Tissue:**

The structural and functional unit of nervous tissue is nerve cell or neuron. Each neuron consists of **cell body** having a **nucleus**, and a number of thin extensions.

One type of extension called **dendrite**, generally conveys signals toward the cell body, another type, the **axon** usually transmits signals away from the cell body. To carry messages, the neurons are thin and long.

BIOLOGY NOTES FOR 9TH CLASS



Q15. Describe the major Plant tissues in terms of their cell specifications, location and functions?

Ans: Plant Tissues:

A collection of similar cells performing an organized function for the plant is called plant tissue. Each plant tissue is specialized for a unique purpose and can be combined with other tissues to create organs such as flowers, leaves, stems and roots.

Types / Groups of Plant tissues:

Plant tissues have been divided into two main groups:

- i. Simple tissues
- ii. Compound tissues

i. Simple Tissues:

Simple tissues are composed of only one type of cells having same function.

Types of Simple Tissues:

The simple tissues consist of two main types:

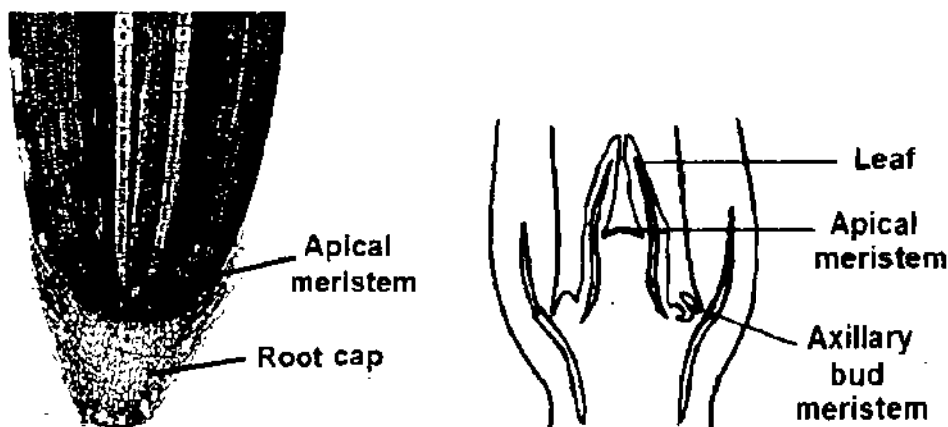
- (a) Meristematic tissues
- (b) Permanent tissues

(a) Meristematic Tissues:

Meristematic tissues are composed of cells having power of division. Cells are thin walled and have no intercellular spaces. Meristematic tissues are found at the apex of root and shoot. These tissues are called **apical meristem**, which divides to form more primary tissue and as a result the root and shoot elongate. This type of growth is called **primary growth**.

Meristematic cells are also found on the lateral sides of roots and stem. The two lateral meristems are: vascular cambium and cork cambium. These cells divide to form secondary tissues, which increase the thickness i.e., girth of stem and root. This is called **secondary growth**.

BIOLOGY NOTES FOR 9TH CLASS



Apical meristematic tissues

(b) Permanent Tissue:

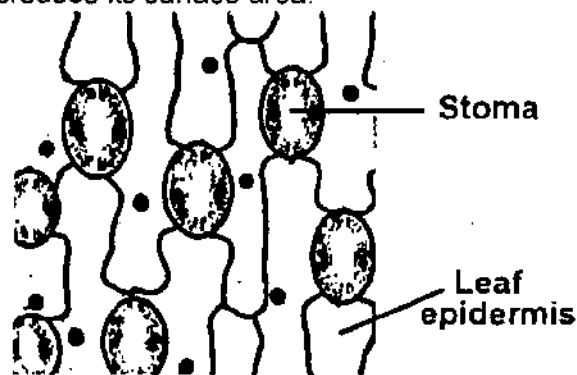
The cells of permanent tissue do not divide. These cells originate from primary meristem.

Types of Permanent Tissues:

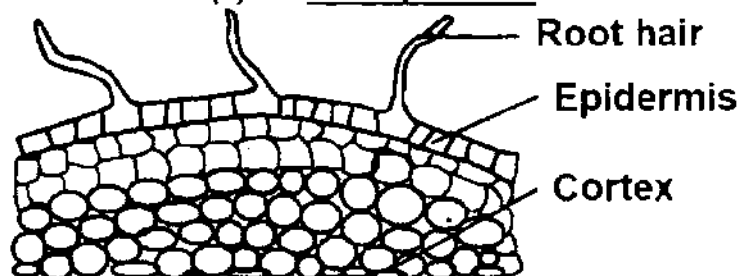
There are three types of permanent tissues: (a) Epidermal tissue (b) Ground tissue (c) Supporting tissue

(a) Epidermal Tissue:

Epidermis is one cell thick layer that covers the whole of the plant body i.e., root, stem and leaf. The cells of the epidermal tissue are living, thick walled and closely packed with no intercellular spaces. The epidermis of leaves has pores called stomata, for the exchange of gases. Root epidermal cells grow hair like extension, which increases its surface area.



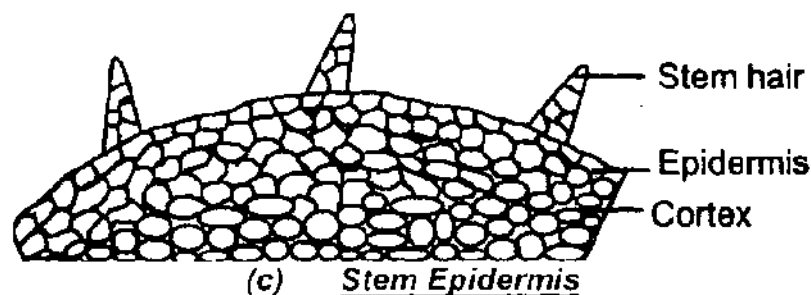
(a) Leaf Epidermis



(b) Root Epidermis

BIOLOGY NOTES FOR 9TH CLASS

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(b) **Ground Tissue:**

The herbaceous plants are mainly composed of ground tissue, which consist of parenchyma cells. **Parenchyma** cells may be spherical or elongated. The cells are large in size, surrounded by thin primary wall and have no secondary walls. Parenchyma cells are responsible for photosynthesis and food storage e.g., mesophyll tissues of leaves



(c) **Supporting Tissues:**

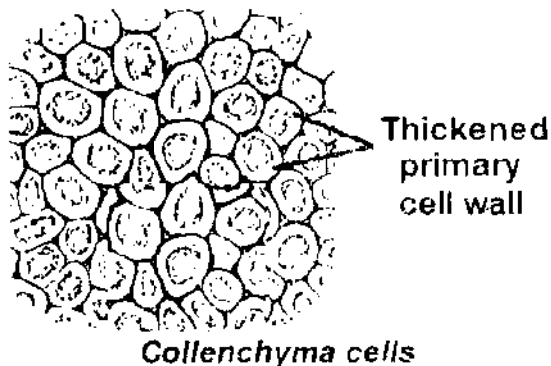
Supporting tissues are also known as **mechanical tissues**. They provide strength and flexibility to plant.

Types of Support Tissues:

Supporting tissues are of two types: a) Collenchyma (b) Sclerenchyma.

(a) **Collenchyma:**

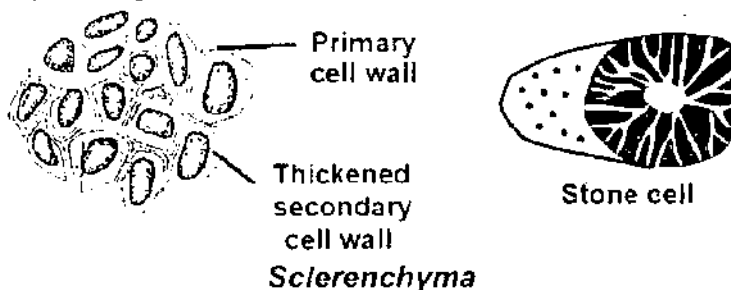
The cells lack secondary walls, but they have thicker primary walls. Collenchyma cells are found in the cortex of the midrib, petioles of the leaves and in young stem. Their main function is to provide support in parts of the plant that are still growing.



BIOLOGY NOTES FOR 9TH CLASS

(b) **Sclerenchyma:**

The cells of sclerenchyma are dead and thick walled. The secondary cell walls are heavily thickened with the deposit of lignin, which provides hardness and strength to the cell. There are two types of sclerenchyma cells, namely fibre and sclereid. Fibre is long and slender, and usually occurs in xylem and phloem. Sclereid is also known as **stone cell**. Sclereids are usually spherical in shape. It is found in seed coats and provides hardness. The main functions of the sclerenchyma are to assist in providing support and mechanical strength to the plant.



Sclerenchyma

ii. **Compound Tissues:**

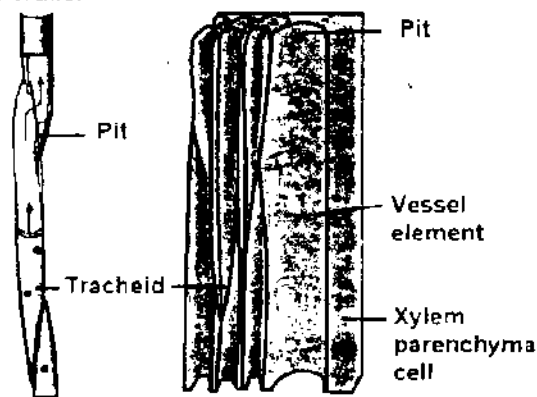
There are two types of compound tissues in plants: (a) Xylem (b) Phloem. Together they form the vascular bundle. Both xylem and phloem are composed of more than one type of cells. Thus, the tissues, which are composed of different kinds of cells performing a common function, are called compound or complex tissue.

Types of Compound (Complex) Tissues:

(a) **Xylem:** Xylem has two main functions, the conduction of water and mineral salts, and to provide support and strength. Xylem consists of two main types of cells namely tracheids and vessel elements.

Tracheids: Tracheids are elongated cells having tapering end walls that overlap with adjacent tracheids. The cell wall is lignified and has pits. Tracheids are hollow, empty, dead cells when mature and only their cell walls remain. Tracheids have mechanical strength and give support to the plant.

Vessels: Vessels are very long, tubular structures formed by the fusion of several cells end to end in a row. Each cell is called vessel element. It is a dead, empty cell having dissolved end walls.



Xylem cells - Tracheid and vessel

BIOLOGY NOTES FOR 9TH CLASS

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(b) **Phloem:**

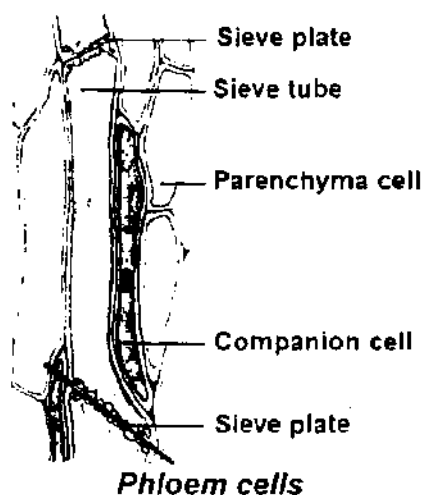
It has a tubular structure. It conducts prepared food from leaves to stem and roots etc. Phloem tubes are composed of living cells with cytoplasm and have no mechanical function. There are two main types of cells in the phloem, namely sieve tube element and companion cells.

Sieve Tubes:

These are formed by end-to-end fusion of cells called sieve tube elements. Sieve tube elements have porous end walls called sieve plate. The cytoplasm is continuous through sieve plate pores.

Companion Cells:

The cells attached to sieve tube elements are called companion cells. They regulate or control the movement of food through the sieve tube.



SUMMARY

1. The light microscope enables us to see the overall shape and structure of a cell.
2. The greater resolving power of electron microscope allows greater magnification and reveals cellular details.
3. The cell is considered as the basic unit of life because it is the smallest unit of living material.
4. Modern cell theory states that organisms are composed of cells and products of cells. All cells arise by division of pre-existing cells.
5. Every cell is surrounded by cell membrane. The cell membrane is a highly fluid mixture of phospholipids and proteins.
6. A nucleus is a double membrane system with pores that communicates with the cytoplasm. It contains genetic information, which is carried by the DNA. Nucleolus is a region in the nucleus that is the site for ribosomal RNA synthesis and ribosome assembly.

BIOLOGY NOTES FOR 9TH CLASS

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7. Mitochondria are double membrane organelles in which the inner membrane is folded to form cristae. Mitochondrion is the site of aerobic respiration.
 8. Golgi bodies is a series of flattened membrane sacs that process, sort, modify proteins synthesized on the ER, and transport proteins to the plasma membrane, to the outside the cell and the lysosomes.
 9. The endoplasmic reticulum is a series of internal membrane with many functions, i.e., protein synthesis, lipid synthesis and transport.
 10. Ribosomes are the site of protein synthesis.
 11. Lysosomes breakdown organic molecules like protein into simpler compound that can be used by the cells.
 12. Plant cell has cell wall, plastids and large vacuole.
 13. The internal structure of a leaf consists of upper epidermis, lower epidermis, palisade, mesophyll and spongy mesophyll.
 14. Root hair cells, xylem vessels and red blood cells are adapted to their particular functions.
 15. Prokaryotic cells are bounded by a plasma membrane but lack a nucleus and have little or no internal membrane organization.
 16. Cell's size and shape relate to function. At minimum a cell must be large enough to house the parts it needs to survive and reproduce.
 17. The maximum size of a cell is limited by the amount of surface needed to obtain nutrients from its environment and dispose of waste.
 18. A small cell has a greater ratio of surface area to volume than a large cell of the same shape.
 19. Diffusion is the net movement of a substance down its concentration gradient (from a region of high concentration to one of low concentration).
 20. Osmosis is a kind of diffusion in which molecules of water pass through a selectively permeable membrane from a region where water has a higher effective concentration to a region where its effective concentration is lower.
 21. Some substances pass through membranes by facilitated diffusion in which a carrier protein helps a molecule move through the membrane.
 22. In endocytosis material, such as food may be moved into the cell. In exocytosis the cell ejects waste products or secretes substances such as mucus.
 23. A tissue consists of group of similarly specialised cells that associate to perform one or more functions.
 24. Animal tissues are classified as epithelial, connective, muscular or nervous.
 25. The simple plant tissue consists of meristematic tissues and permanent tissues. A compound tissue consists of xylem and phloem.

BIOLOGY NOTES FOR 9TH CLASS

EXERCISE

(MCQs)

- **Select the correct answer:**
- A network of channels extending from cell membrane to nuclear membrane is called:**
A. centriole
B. endoplasmic reticulum
C. ribosomes
D. centrosome
 - The site of enzyme synthesis in cells is:**
A. lysosome
B. smooth endoplasmic reticulum
C. Golgi bodies
D. ribosome
 - In which organelle are nucleic acids absent?**
A. chloroplast
B. Golgi apparatus
C. mitochondrion
D. nucleus
 - The concentration of calcium in a cell is 0.9%. The concentration of calcium in the surrounding fluid is 0.1%. How could the cell obtain more calcium?**
A. passive transport
B. osmosis
C. diffusion
D. active transport
 - What is the main advantage of small cell size?**
A. small cells can better take up what they need from the environment
B. small cells are less likely to burst than large cells
C. small cells can change shape easily
D. small cells require less energy to divide
 - Which of the following clues would tell you whether a cell is prokaryotic or eukaryotic?**
A. whether or not the cell is partitioned by internal membrane.
B. the presence or absence of a single rigid wall.
C. the presence or absence of ribosomes.
D. whether or not the cell contains DNA.
 - Which of the following helps root hair cells to take up water?**
A. fibres
B. vacuole
C. xylem vessel
D. large surface area
 - What is the major advantage of using a light microscope instead of an electron microscope?**
A. ability to observe living matter
B. superior resolution
C. use of very thin section
D. constant depth of focus

BIOLOGY NOTES FOR 9TH CLASS

9. Which of the following clues would tell you whether a cell is prokaryotic or eukaryotic?

- A. whether or not the cell is partitioned by internal membrane
- B. the presence or absence of a single rigid wall
- C. the presence or absence of ribosomes
- D. whether or not the cell contains DNA

10. Which of the following helps root hair cells to take up water?

- A. fibres
- B. vacuole
- C. xylem vessel
- D. large surface area

11. What is the major advantage of using a light microscope instead of an electron microscope?

- A. ability to observe living matter
- B. superior resolution
- C. use of very thin section
- D. constant depth of focus

12. How do nitrate ions, oxygen and water enter root hair cells?

	By diffusion	By osmosis	By active transport
A.	oxygen	water	nitrate ions
B.	water	oxygen	nitrate ions
C.	nitrate ions	water	oxygen
D.	water	nitrate ions	oxygen

13. The table shows three functions of cells which row is correct?

	absorption	support	transport
A.	red blood cell	muscle cells	root hair cell
B.	root hair cell	xylem vessel	red blood cell
C.	muscle cell	red blood cell	xylem vessel
D.	xylem vessel	root hair cell	muscle cell

14. The resolving power or resolution of a microscope may be defined as:

- A. sharpness of image
- B. smallest object can be seen
- C. highest magnification
- D. ability to distinguish between two objects

15. The table shows the presence or absence of nucleus in three types of cells. Which option is correct?

	Red blood cells	Companion cells	Sieve element
A.	absent	present	absent
B.	absent	present	present
C.	present	absent	present
D.	present	absent	absent

BIOLOGY NOTES FOR 9TH CLASS

16. What are the functions of xylem and phloem in green plants?

	xylem	Phloem
A	transport of water	support and transport of sugars
B	transport of sugars	support and transport of water
C	support and transport of water	transport of sugar
D	Support & transport of sugars	transport of water

17. What are the functions of mitochondria?

- | | |
|--------------------|-------------------------|
| A. lipid synthesis | B. protein synthesis |
| C. photosynthesis | D. cellular respiration |

18. A red blood cell and a plant root hair cell both have

- | | |
|--------------------------|----------------|
| A. a cellulose cell wall | B. haemoglobin |
| C. a large surface area | D. a nucleus |

19. Which cell component is related to pinocytosis?

- | | |
|------------------|--------------|
| A. cell membrane | B. lysosomes |
| C. nucleus | D. ribosomes |

20. Which of the following is present in all eukaryotic cells?

- | | |
|--------------|------------------------------|
| A. cell wall | B. membrane bound organelles |
| B. flagellum | D. flagellum |

ANSWERS:

1. B	2. A	3. B	4. D	5. A
6. A	7. D	8. B	9. A	10. D
11. B	12. A	13. B	14. D	15. B
16. C	17. D	18. C	19. A	20. B

SHORT QUESTIONS

Q1. Can you differentiate between:

- (a) Light microscope and electron microscope
- (b) Transmission electron microscope and scanning electron microscope
- (c) Viruses and prions
- (d) Prokaryotic cells and eukaryotic cells
- (e) Meristematic and permanent tissue
- (f) Xylem and phloem
- (g) Pinocytosis and phagocytosis
- (h) Exocytosis and endocytosis
- (i) Diffusion and osmosis
- (j) Turgor pressure and osmotic pressure.

Ans: (a) Light microscope and electron microscope:

BIOLOGY NOTES FOR 9TH CLASS

Light microscope	Electron microscope
Light microscope uses visible light to view objects.	Electron microscope (EM) uses a fine beam of electrons transmitted to a specimen in vacuum.
It has two lenses i.e., eye piece and objective.	EM uses electromagnets as lenses and image is formed on screen.
Its magnification can be 1500 X and resolution can be 0.2 μm .	Its magnification can be up to 1,000,000 X and resolution can be 0.2 nm. 1 mm = 1000 μm ; 1 μm = 1000 nm

(b) Transmission electron microscope and scanning electron microscope:

Transmission electron microscope (TEM)	Scanning electron microscope (SEM)
TEM is used to study the details of internal cell structure. Specimens are cut into extremely thin sections.	SEM is used to study the cell surface which reveals the three-dimensional details of the surface
In TEM, electrons are transmitted through the specimen.	In SEM, electrons are reflected from the metal-coated surfaces.

(c) Viruses and prions:

Viruses	Prions
Viruses are acellular structures.	Prions are infectious particles that are composed only of proteins.
It is made up of nucleic acids covered with a protein coat	They contain do not have DNA or RNA
They cannot carry out metabolic activities independently.	Prions can replicate or reproduce
Measles, mumps, chickenpox, and influenza are some viral diseases.	prions cause misfolding of normal proteins in the brain.

(d) Prokaryotic cells and eukaryotic cells:

Prokaryotic cells	Eukaryotic cells
Prokaryotes include bacteria and cyanobacteria.	Eukaryotes include protists, fungi, plants and animals
Have no nucleus. DNA is coiled into nucleoid region	Have nucleus. DNA is in the nucleus. Nucleus is surrounded by nuclear membrane.
DNA is in direct contact with the cytoplasm.	DNA is not in direct contact with the cytoplasm
No membrane bounded organelles are present.	Membrane bounded organelles are present.

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Ribosomes are of small size and freely scattered in the cytoplasm.	Ribosomes are of large size and are present on endoplasmic reticulum and also freely dispersed in the cytoplasm.
Cell wall is composed of peptidoglycan. Cellulose is absent.	Cell wall of plant cell is composed of cellulose, while in fungi it is of chitin.
Prokaryotic cells are comparatively smaller in size.	Eukaryotic cell is comparatively larger in size.

(e) Meristematic and permanent tissue:

Meristematic tissue	Permanent tissue
Meristematic tissues are composed of cells having power of division.	The cells of permanent tissue do not divide.
Cells are thin walled and have no intercellular spaces.	These cells originate from primary meristem.
Meristematic tissues are found at the apex of root and shoot. These tissues are called apical meristem .	There are three types of permanent tissues: (a) Epidermal tissue (b) Ground tissue (c) Supporting tissue

(f) Xylem and phloem:

Xylem	Phloem
Xylem has two main functions, the conduction of water and mineral salts.	It has a tubular structure. It conducts prepared food from leaves to stem and roots etc.
It provide support and strength.	Phloem tubes are composed of living cells with cytoplasm and have no mechanical function.
Xylem consists of two main types of cells namely tracheids and vessel elements.	There are two main types of cells in the phloem, namely sieve tube element and companion cells.

(g) Pinocytosis and phagocytosis:

Pinocytosis:	Phagocytosis
It occurs when material taken up is in liquid form.	When the material taken in by the endocytosis is in solid form, the process is called phagocytosis.
In humans, this process occurs in cells lining the small intestine and is used primarily for absorption of fat droplets.	Amoeba engulfs Paramecium etc, and some white blood cells take up bacteria by phagocytosis.

BIOLOGY NOTES FOR 9TH CLASS

(h) Exocytosis and endocytosis:

Exocytosis	Endocytosis
During exocytosis a cell discharges material by packaging it in secretory vesicles and moving the vesicle to the cell surface.	Endocytosis is a cellular process in which substances are brought into the cell.
The membrane of the vesicle fuses with the cell membrane and the contents are expelled out.	The material to be internalized is surrounded by an area of cell membrane, which then buds off inside the cell to form a vesicle containing the ingested material.

(i) Diffusion and osmosis:

Diffusion	Osmosis
Diffusion is the tendency of particles to spread out from more concentrated to less concentrated area.	Osmosis is a special type of diffusion involving water molecules.
Diffusion results from random motion of atoms and molecules.	It occurs when a partially permeable membrane separates two solutions of different concentrations.
Diffusion is one principle method of movement of substances within cells, as well as across cell membrane. Gas exchange in gills and lungs occurs by this process.	Osmosis is the passage of water molecules from a dilute solution into a concentrated solution through a partially permeable membrane.

(j) Turgor pressure and Osmotic pressure:

Turgor pressure	Osmotic pressure
The swelling of a plant cell in hypotonic solution creates turgor pressure.	Osmotic pressure is defined as the pressure that must be applied to the solution side to stop fluid movement when a semipermeable membrane separates a solution from pure water.
Any concentration of salt solution lower than 0.9% is hypotonic to red blood cells. Red blood cells placed in such a solution expand and sometimes burst	Osmosis occurs when two solutions containing different concentrations of solute are separated by a selectively permeable membrane.

Q2. How the cell theory was developed?

Ans: History of the formation of cell theory:

The ancient Greeks were the first to make comprehensive attempts to organize the data of the natural world.

The contribution of Aristotle was his awareness that all knowledge of animals and plants somehow could be related.

BIOLOGY NOTES FOR 9TH CLASS

Robert Hooke (1665) looked at a thin slice of cork under his microscope. Hooke saw that the cork was made of tiny empty spaces with walls around them. He called the little box-like structures as cells because it reminded him the small rooms. Today scientists know that what Hooke really saw was only one part of the cells. He saw the thick cell walls.

Robert Brown (1831) discovered nucleus in the plant cells.

Schleiden (1838) was a botanist. He came to the conclusion that all plants are composed of cells.

Theodor Schwann (1839) was a zoologist who came to the conclusion that animals also consist of cells.

Virchow (Rudolph) (1855) proposed that living cells arise from pre-existing cells and wrote, "omnis cellula e cellula" (all cells arise from cells).



Cork cells as seen by Hooke

Louis Pasteur (1862) experimentally proved that microorganisms i.e., bacteria could be formed only from existing bacteria. From all these information scientists were led to one of the important concepts in biology. This concept is **cell theory**.

Modern cell theory states that:

- i. All living organisms are made up of cells.
- ii. A cell is the structural and functional unit of organisms.
- iii. New cells are formed when pre-existing cells divide.

Q3. Why are the following scientists famous for?

- | | |
|------------------|---------------------------|
| (a) Aristotle | (b) Robert Hooke |
| (c) Robert Brown | (d) Schwann and Schleiden |

Ans: Contributions of famous scientists:

(a) **Aristotle:**

The contribution of Aristotle was his awareness that all knowledge of animals and plants somehow could be related.

(b) **Robert Hooke:**

Robert Hooke (1665) looked at a thin slice of cork under his microscope. Hooke saw that the cork was made of tiny empty spaces with walls around them. He called the little box-like structures as cells because it reminded him the small rooms. Today scientists know that what Hooke really saw was only one part of the cells. He saw the thick cell walls.

(c) **Robert Brown:** Robert Brown (1831) discovered nucleus in the plant cells.

(d) **Schwann and Schleiden:**

Theodor Schwann (1839) was a zoologist who came to the conclusion that animals also consist of cells. **Schleiden** (1838) was a botanist. He came to the conclusion that all plants are composed of cells.

BIOLOGY NOTES FOR 9TH CLASS

Q4. How the size and shape of the cell is related to surface area to volume ratio?

Ans: Relationship between cell size and shape and surface area to volume ratio:

The surface area to volume ratio limits the cell size because the bigger the cell gets the less surface area it has for its size. Thus, if the cell grows beyond a certain limit, not enough material will be able to cross the membrane fast enough to support life.

The important point is that the surface area to the volume ratio gets smaller as the cell gets larger. Thus, if the cell grows beyond a certain limit, not enough material will be able to cross the membrane fast enough to accommodate the increased cellular volume. That is why cells are so small.

Only few cells are large in nature like bird's eggs but they are mainly storage structures. Metabolically active cells are always small so that their surface area to volume ratio is high. Rapid and efficient exchange of material is possible when cell surface area to volume ratio is high.

	One large cell	27 small cells
Total Surface Area = (height × width × sides × number of cells)	54μm ²	162μm ²
Total Volume = (height × width × length × number of cells)	27μm ³	27μm ³
Surface area to volume ratio	2	6

Q5. Explain the importance of following:

- | | |
|---------------------------|---------------------------|
| (a) diffusion | (b) facilitated diffusion |
| (c) osmosis | (d) active transport |
| (e) cells smaller in size | (f) turgor |

Ans: (a) Importance of Diffusion:

Diffusion is important to cells because it allows them to gain the useful substances they require to obtain energy and grow, and lets them get rid of waste products.

Diffusion is the movement of molecules from an area of higher concentration to the area of lower concentration i.e. along concentration gradient

Diffusion is one principle method of movement of substances within cells, as well as across cell membrane. Carbon dioxide, oxygen, glucose etc. can cross cell membranes by diffusion. Gas exchange in gills and lungs occurs by this process. Movement of glucose molecules from small intestine lumen into the blood capillaries of villi is another example of diffusion.

(b) Importance of facilitated diffusion:

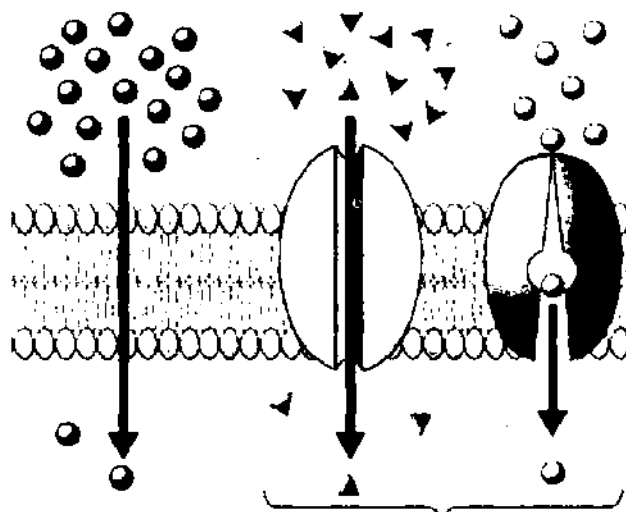
Facilitated diffusion is important because it regulates what goes in and what goes out of the cell.

When a transport protein moves a substance from higher to lower concentration, the process is called facilitated diffusion.

The rate of facilitated diffusion is higher than simple diffusion. Important cellular mechanisms like transport of oxygen, nutrients, and ions which are essential to maintain optimal homeostasis in the cell are performed through facilitated diffusion.

BIOLOGY NOTES FOR 9TH CLASS

Facilitated diffusion is also a type of **passive transport** because there is no expenditure of energy.



Diffusion Facilitated diffusion

Diffusion and Facilitated diffusion

(c) Importance of osmosis:

It helps in the movement of important materials inside and out of the cell. The nutrients, water and other solutes move in and out of the cell by the process of osmosis.

(d) Importance of active transport:

Active transport is a very important process enabling cells to accumulate molecules or ions from the environment against the concentration gradient. Conversely, contents of cells heavily loaded with electrolytes or metabolic products can be excreted against the concentration gradient.

Active transport is involved in many processes. For example, uptake of dissolved mineral salts by the root hairs, absorption of glucose and amino acids by cells in the small intestine of humans.

The cell membranes of neuron have **sodium potassium pumps**. By activity of these pumps neuron maintain more sodium outside and more potassium inside. Such ionic distribution is necessary for proper working of neuron.

(e) Importance of cells smaller in size:

The surface area to volume ratio limits the cell size because the bigger the cell gets the less surface area it has for its size. Thus, if the cell grows beyond a certain limit, not enough material will be able to cross the membrane fast enough to support life.

Cells are so little, so they can maximize their ratio of surface area to volume. Smaller cells have a higher ratio which allows more molecules and ions to move across the cell membrane per unit of cytoplasmic volume. Cells are so small because they need to be able to get the nutrients in and the waste out quickly.

BIOLOGY NOTES FOR 9TH CLASS

(f) Importance of turgor:

- i. It maintains the shape of the cell.
- ii. It gives rigidity to the cells and maintains their structure.
- iii. It is the basis of the opening and closing of stomata. When turgor pressure is high the stomatal pore opens and when the turgor pressure is low the stomatal pore closes.
- iv. Cells and organelles remain stretched.

Q6. Why osmosis can be considered as a special type of diffusion?

Ans: Osmosis is a special type of diffusion involving water molecules. It occurs when a partially permeable membrane separates two solutions of different concentrations. Osmosis is the passage of water molecules from a dilute solution into a concentrated solution through a partially permeable membrane.

OR

(Second Answer)

Osmosis is a special kind of diffusion because in both cases there is a movement of particles from a higher concentration region to a lower concentration region. The only difference is that osmosis is applicable to the movement of the solvent only through the semi-permeable membrane where the solvent is water.

Q7. Why electron microscope cannot be used to study life processes?

Ans: For an electronic microscope to be effective, it works in vacuum so that the beam of electrons (the main source of illumination) is not scattered by air molecules. The specimen is placed in a vacuum chamber. Cells cannot survive in a vacuum hence only studied when dead in an electron microscope.

The disadvantage of studying dead cells is that they limit the understanding of cellular processes because they cannot be viewed in real-time. Studying live cells allows scientists to understand physiological changes of cells and their biological relevance.

EXTENSIVE QUESTIONS

Q1. Describe the structure and functions of animal cell. How it is different from plant cell?

Ans: Animal Cell:

A eukaryotic cell has membrane bound nucleus and organelles. Animal cells have no cell wall and chloroplast.

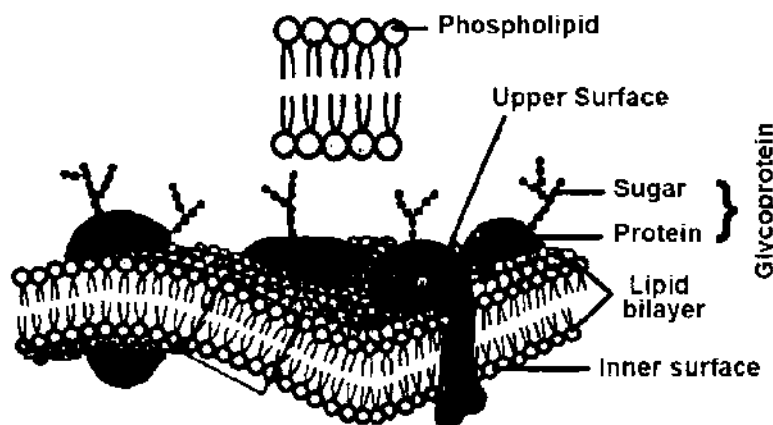
Structure and functions of animal cell:

i. Cell Membrane:

It is also called **plasma** membrane. An animal cell is surrounded by a cell membrane. Chemically cell membrane consists of proteins, lipids and a small quantity of carbohydrates. The membrane structure is represented by **fluid mosaic model**.

It proposed that the cell membrane has a fluid phospholipid bilayer in which protein molecules are either partially or wholly embedded. The plasma membrane forms the cell's point of contact with its environment.

BIOLOGY NOTES FOR 9TH CLASS



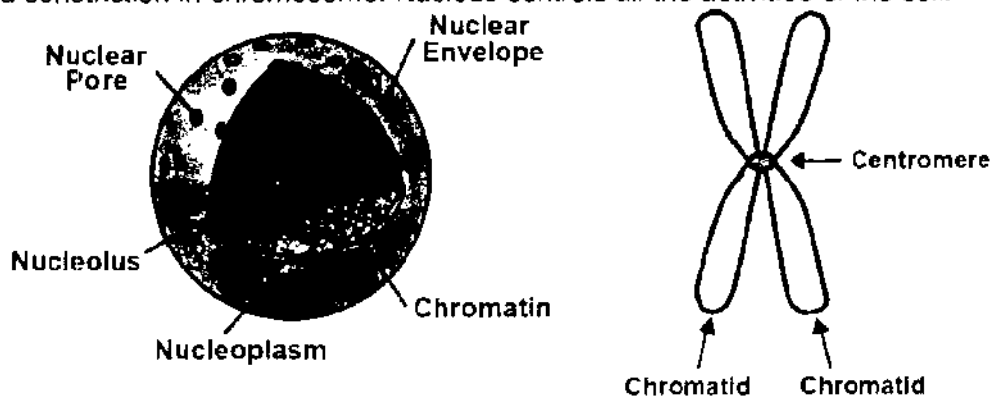
Fluid mosaic model of plasma membrane

It stops the cell contents from escaping and also controls the substances, which are allowed to enter and leave the cell. In general, oxygen, food and water are allowed to enter, waste products are allowed to leave and harmful substances are kept out. So, the cell membrane is called differentially or selectively permeable membrane.

ii. Nucleus:

It is located in central region. Nucleus consists of a double nuclear membrane, nucleoplasm, nucleolus and chromosomes. The surface of the nucleus is bounded by a double nuclear membrane called **nuclear envelope**.

The nuclear membrane has many pores. The fluid inside the nucleus is called **nucleoplasm**. The dark staining region in the nucleus is called **nucleolus**. The threads like structures in the nucleus are called **chromosomes**. Chemically chromosomes consist of deoxyribonucleic acid (DNA) and protein. The **centromere** is a constriction in chromosome. Nucleus controls all the activities of the cell.



Structure of Nucleus

iii. Cytoplasm: The material between cell membrane and nuclear membrane is called cytoplasm. It contains all the organelles. Many biochemical reactions take place in the cytoplasm for example glycolysis

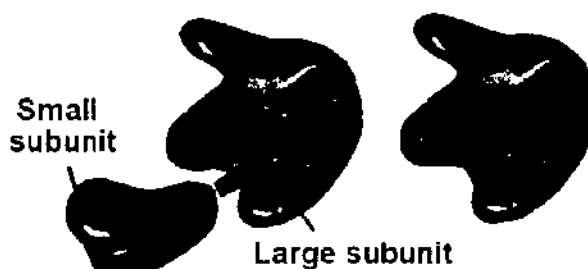
iv. Ribosomes: Ribosomes are granular bodies. They may exist in two forms (a) Attached with ER. (b) Freely dispersed in the cytoplasm. Ribosomes are made up of equal amounts of RNA and protein.

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Ribosomes are not bounded by membrane. They are found in prokaryotes and eukaryotes.

Ribosomes are composed of two subunits of different sizes, the large and the small. The two subunits on attachment form ribosomes. Ribosomes are the sites of protein synthesis i.e.; amino acids are joined one by one to form protein.

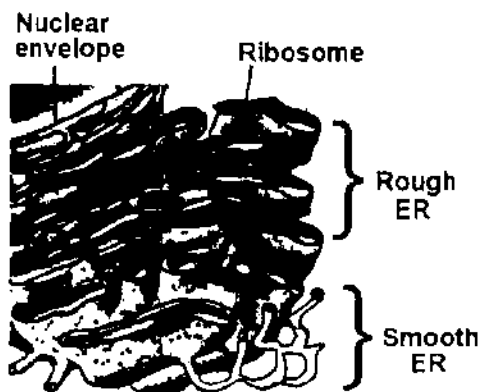
Ribosomes are composed of two subunits of different sizes, the large and the small. The two subunits on attachment form ribosomes. Ribosomes are the sites of protein synthesis i.e.; amino acids are joined one by one to form protein.



Ribosomes

v. Endoplasmic Reticulum (ER):

It is a network of interconnected channels. The ER is continuous with plasma membrane, nuclear membrane, and Golgi apparatus. There are two types of ER i.e.; **smooth ER** and **rough ER**. In smooth ER ribosomes are not attached to it. Smooth ER plays an important role in lipid formation. Smooth ER form vesicles in which large molecules are transported to other parts of the cell. In liver it helps to detoxify drugs. Rough ER has ribosomes attached with it. Rough ER is involved in protein synthesis.



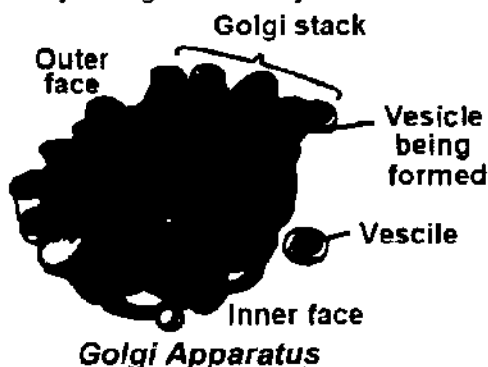
Rough ER and smooth ER

vi. Golgi Apparatus:

It was discovered by Italian scientist Camillo Golgi in 1898. Golgi apparatus is also known as Golgi bodies or Golgi complex. The electron microscope has revealed that a Golgi apparatus is a stack of flattened sacs formed of membranes. Most cells contain 10 to 20 sets of these flattened membranes. In cells, the inner face of the stack is directed toward the endoplasmic reticulum and the outer face of the stack is directed towards the plasma membrane. Vesicles are seen at the edges of the stack. The Golgi apparatus receives vesicles that bud off from the

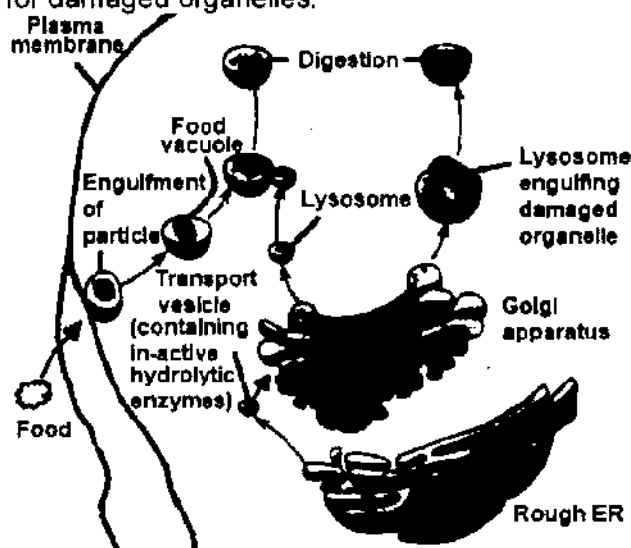
BIOLOGY NOTES FOR 9TH CLASS

endoplasmic reticulum and modify them. They store the secretion and finally release them in secretory vesicles. They also give rise to lysosome.



vii. Lysosomes:

Lysosomes are roughly spherical structures bounded by a single membrane. Lysosomes contain various active hydrolytic enzymes which breakdown proteins, nucleic acids, lipids and carbohydrates. Lysosomes have several types of digestive functions. Many cells engulf nutrients into tiny cytoplasmic sacs called food vacuoles. Lysosomes fuse with food vacuole, exposing the nutrients to hydrolytic enzymes that digest them. Small molecular products of digestion, such as amino acids, leave the lysosomes and are reused by the cell. Lysosomes serve as recycling centres for damaged organelles.



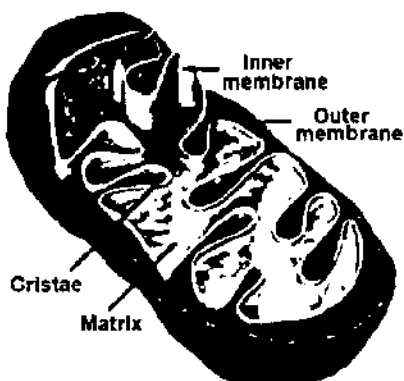
Lysosomes: formation and functions

viii. Mitochondrion:

Mitochondria are spherical, rod-like or elongated tiny organelles. Under EM a mitochondrion is a double membrane structure. The outer membrane is smooth. The inner membrane is folded to form cristae. Cristae provide a much greater area. Mitochondrial solution is called matrix.

The mitochondria are called the powerhouse of the cell because it produces energy in the form of ATP (Adenosine triphosphate). DNA, ribosomes and enzymes are present in mitochondria.

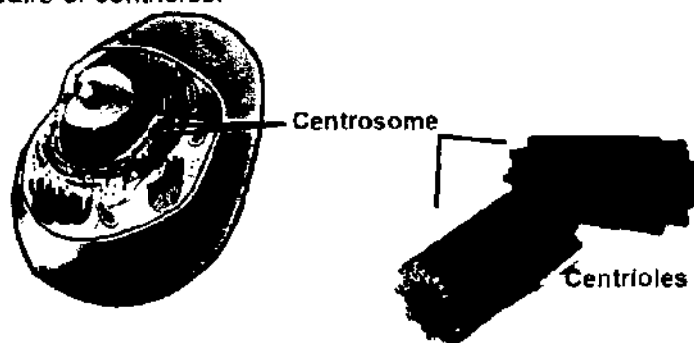
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Mitochondrion

ix. Centriole:

A pair of centrioles located near the outer surface of the nucleus. The two centrioles are usually placed at right angles to each other in a structure called centrosome. It consists of a triplet of microtubules arranged to form a hollow cylinder. Just before cell division the centrioles duplicate and each pair migrates to the opposite side of the nucleus. The spindle fibres are then formed between the two opposite pairs of centrioles.



A pair of centrioles

x. Cytoskeleton:

Eukaryotic cells contain a supportive network of fine fibres, which is collectively called the cytoskeleton. Cytoskeleton is responsible for the cell shape and movement. Three main kinds of fibres make up the cytoskeleton:

- **Microfilament,** the thinnest
- **Microtubules,** the thickest
- **Intermediate filaments,** with in between thickness.

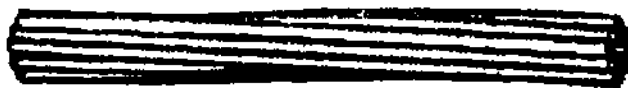


(a) Microfilament



(b) Microtubule

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(c) Intermediate filament

xi. Cilia and Flagella:

Some eukaryotic cells have extensions that look somewhat like hair. These structures are called **cilia**. Some cells have whip like extensions called **flagella**. Cilia and flagella consist of nine pairs of microtubules which surround a single central pair. They are connected to the **basal body**. The basal body serves to make and anchor a cilium or flagellum to the cell.



(a) Flagella



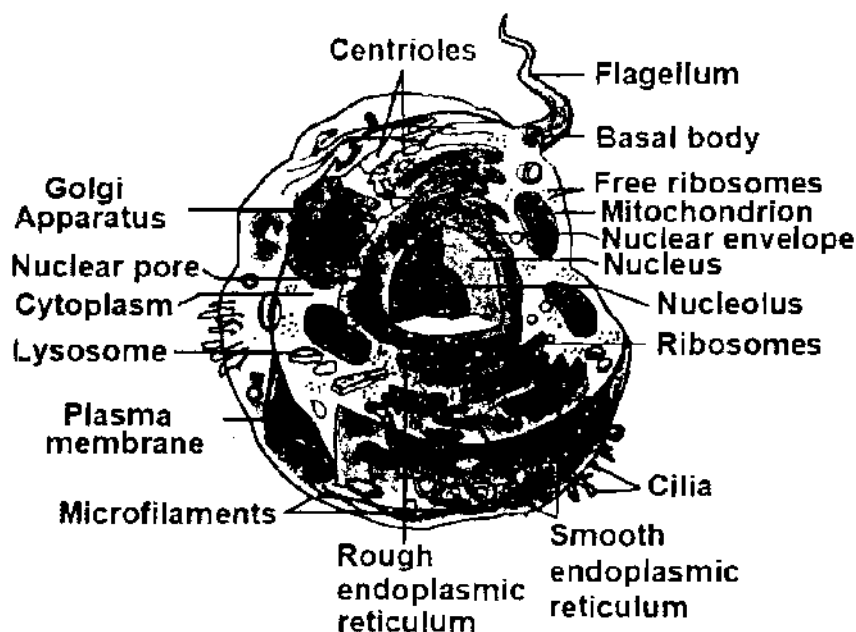
(b) Cilia

Differences between plant cell and animal cell:

Plant cells have a cell wall, but animals cells do not. Cell walls provide support and give shape to plants.

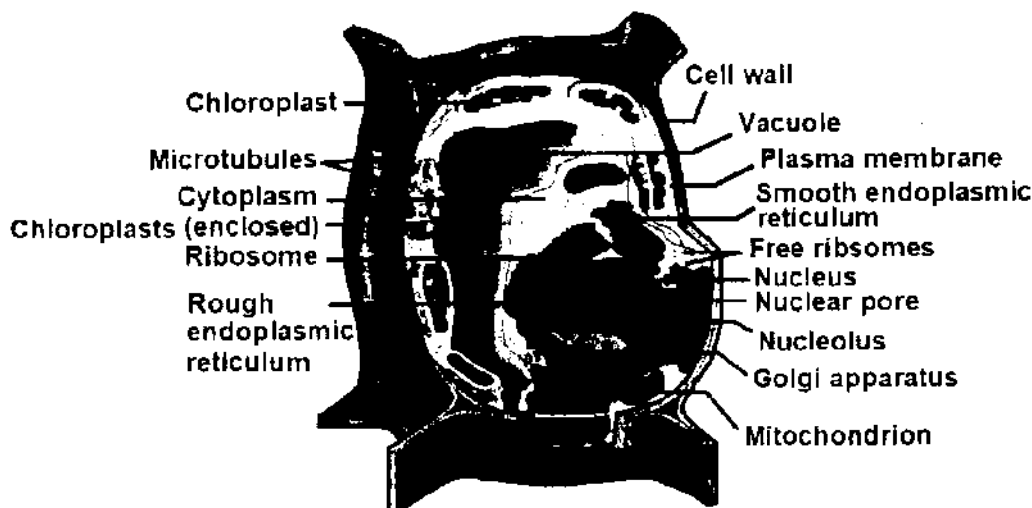
Plant cells have chloroplasts, but animal cells do not. Chloroplasts enable plants to perform photosynthesis to make food.

Plant cells usually have one or more large vacuole(s), while animal cells have smaller vacuoles, if any are present. Large vacuoles help provide shape and allow the plant to store water and food for future use. The storage function plays a lesser role in animal cells, therefore the vacuoles are smaller.



Electron microscopic structure of animal cell

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Electron microscopic structure of a plant cell

Q2. Justify how the cells of leaf system have a variety of specialized structure and function.

Ans: Structure and Functions of cells of a Leaf:

A leaf has a variety of cells. Each type of cell performs a special function. Leaf cells need water, carbon dioxide and light for photosynthesis. It also needs oxygen for respiration. It transfers food to other parts of the plant. So, there are varieties of functions and accordingly there are varieties of cells.

Epidermis: Epidermis is the outermost layer. It is single layer of cells, covering the leaf surface. A waxy substance called **cutin**, which forms the cuticle, covers the upper epidermis. The function of the epidermis is to protect the tissues and to prevent loss of water.

Stomata:

On the lower epidermis tiny pores are present called **stomata**. Each stoma is enclosed by two guard cells, having chloroplasts. The **guard cells** control the opening and closing of stoma. Exchange of oxygen and carbon dioxide and evaporation of water vapour takes place through stomata.

Mesophyll:

Between the two-epidermal layers lies the group of cells called **mesophyll**. These are of two types – a **palisade mesophyll** and the **spongy mesophyll**. The palisade mesophyll consists of two or three layers of cylindrical cells. These cells contain many chloroplasts. The spongy mesophyll consists of loosely arranged irregular cells having chloroplast. Large intercellular spaces are present among these cells. This arrangement facilitates diffusion of gases.

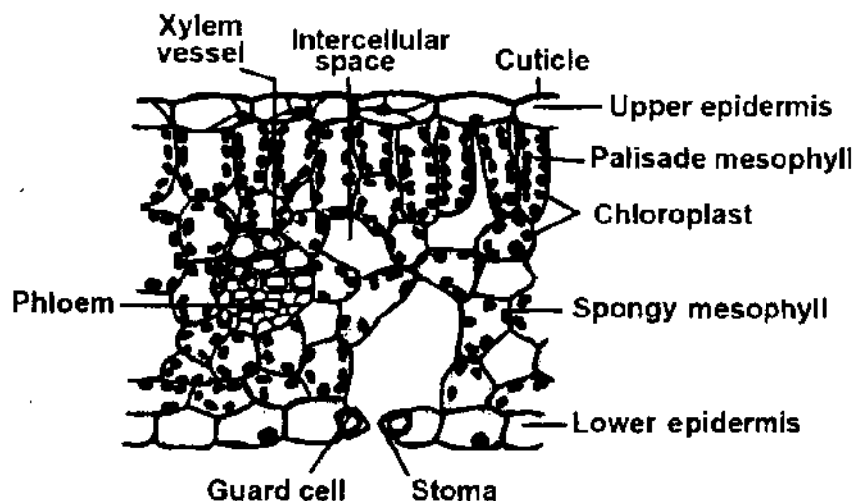
Function of Xylem:

Xylem vessels present in the leaves are long and dead cells. Through xylem cells transportation of water from root to leaves takes place.

Function of Phloem:

The **phloem** cells carry the prepared food from the leaf to other parts of the plant.

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Transverse section of a leaf

Q3. State the relationship between all structure and function of root hairs, xylem vessels and red blood cell.

Ans: Relationship between cell functions and cell structure:

There are different types of plant and animal cells. These cells differ in shape, size and structure. Cells are modified according to their function.

Root Hair Cells: The root hairs are the extensions of the epidermal cells. The root hair is long and narrow. It provides large surface area for the absorption of water and mineral salts from the soil.

Xylem Vessels: They transport water and mineral salts. As there is no cross wall and the cells are empty, so water can move easily through the xylem vessel.

Red Blood Cells:

The red blood cells are enucleated (without nucleus), disk shaped and slightly biconcave. The biconcave shape provides a larger surface for gas diffusion into and out of the cell at a faster rate. Lack of nucleus provides more space for haemoglobin.

The Cell as an Open System:

An open system is one, which is separated from its surroundings by a boundary that allows transfer of materials across it. Cell is an open system because it is separated from its surroundings and allows entry and exit of matter and energy. It takes up food, oxygen, water and salts for survival, growth and division, and energy for metabolic processes. It removes waste products and secretions (matter) and energy in the form of heat.

Q4. Describe diffusion of glucose from intestine to villus epithelium and active transport of sodium ions from nerve cell to outside.

Ans: Diffusion of glucose from intestine to villus epithelium:

The transport of glucose from the intestinal lumen to the blood. Glucose is imported against its concentration gradient from the intestinal lumen across the apical surface of the epithelial cells.

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The process of transport of glucose from intestinal lumen into the absorptive cell has two stages. In the first stage sodium ion from inside the cells are transported to interstitial fluid. This leads to low sodium concentration inside the cell.

Then starts the second stage. As a result of low sodium inside the cells, sodium ions are transported from intestinal lumen by facilitated diffusion (diffusion with the help of transport protein). The transport protein that helps in this case, has a peculiarity. It transports sodium ion with glucose. Actually this protein drags glucose along with sodium ion from the lumen into the cell

Active transport of sodium ions from nerve cell to outside.

The membranes of nerve cells have carrier proteins in the form of "sodium-potassium pump". In a resting (not conducting nerve impulse) nerve cell, this pump spends energy (ATP) to maintain higher concentrations of K^+ and lower concentrations of Na^+ inside the cell. For this purpose, the pump actively moves Na^+ to the outside of the cell where they are already in higher concentration. Similarly this pumps moves K^+ from outside to inside the cell where they are in higher concentration.

Q5. Describe the role of the cell membrane in maintaining equilibrium while exchanging matter?

Ans: Each cell is surrounded by cell membrane, which is selectively permeable membrane (only certain molecules can pass through). So the cell takes necessary substances from the surrounding environment and remove unwanted through a state of equilibrium called homeostasis.

Cell membrane has a fluid phospholipid bilayer in which protein molecules are either partially or wholly embedded. The plasma membrane forms the cell's point of contact with its environment.

It stops the cell contents from escaping and also controls the substances, which are allowed to enter and leave the cell. In general, oxygen, food and water are allowed to enter, waste products are allowed to leave and harmful substances are kept out. So, the cell membrane is called differentially or selectively permeable membrane.

Q6. Can you compare magnification and resolution?

Ans: Yes, we can compare magnification and resolution.

Magnification is the ability to make small objects seem larger, such as making a microscopic organism visible. Resolution is the ability to distinguish two objects from each other. Light microscopy has limits to both its resolution and its magnification.

Magnification:

Magnification is the increase in the apparent size of an object and it is an important factor in microscopy. Magnification serves a useful purpose only when it is possible to see more details of an object in the image than when observing the object with the unaided eye.

Resolving power or resolution:

Resolving power or resolution is the measure of the clarity of an image. It is the minimum distance at which two objects can be seen as separate objects.

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Resolution of human eye:

The human naked eye can differentiate between two points, which are at least 0.1 mm apart. This is known as the resolution of human eye. If we place two objects 0.05 mm apart, human eye would not be able to differentiate them as two separate objects. The resolution can be increased with the help of lenses.

THE TERMS TO KNOW

1. **Active transport:** The movement of molecules from an area of lower concentration to the area of higher concentration, with the expenditure of energy.
2. **Cell:** The smallest living things, the basic unit of organization of all organisms.
3. **Cell membrane:** A thin and elastic membrane covering the cytoplasm of all prokaryotic and eukaryotic cells.
4. **Cell theory:** One of the most fundamental educations about cells, proposed by Schleiden and Schwann.
5. **Cell wall:** The non-living and strong component of the cell, located outside the cell membrane, in plants, fungi, prokaryotes and many protists.
6. **Centriole:** The hollow and cylindrical organelles present in the cells of animals and many unicellular organisms.
7. **Chloroplast:** The green plastids found in plants and many protists; involved in photosynthesis.
8. **Chromoplast:** The plastids with pigments of bright colors; present in flower petals, fruits etc.
9. **Connective tissue:** Animal tissue that supports and binds other tissues.
10. **Cytoplasm:** The semi-viscous and semi-transparent substance present between the plasma membrane and the nuclear envelope.
11. **Diffusion:** The movement of molecules from an area of their higher concentration to the area of lower concentration.
12. **Endoplasmic reticulum:** The network of channels that extends from plasma membrane to the nuclear envelope.
13. **Epithelial tissue:** Animal tissue that covers the outside of the body and lines organs and cavities.
14. **Facilitated diffusion:** The movement of the molecules from higher to lower concentration with the help of transport proteins.
15. **Golgi apparatus:** The set of flattened sac-like structures called cisternae; found in animal and plant cells; involved in cell secretions.
16. **Hypertonic solution:** The solution in which more solute is present.
17. **Hypotonic solution:** The solution in which less solute is present.
18. **Isotonic solution:** The solutions, which has equal concentrations of solutes.
19. **Leucoplast:** The colourless plastids in the cells of those plant parts where food is stored

BIOLOGY NOTES FOR 9TH CLASS

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- 20. **Lysosome:** The single-membrane bound organelles having strong digestive enzymes.
 - 21. **Mitochondria:** The double membrane-bounded structure in eukaryotes; involved in cellular respiration.
 - 22. **Muscle tissue:** Animal tissue composed by cells with ability to contract.
 - 23. **Nucleus:** The most prominent organelle in eukaryotic cell; controls all cell activities.
 - 24. **Organelle:** The sub-cellular structures.
 - 25. **Osmosis:** The movement of water molecules from a solution of lesser solute concentration to a solution of higher solute concentration, across a semi-permeable membrane.
 - 26. **Passive transport:** The movement of materials without any expenditure of energy.
 - 27. **Phagocytosis:** The phenomenon in which cell takes in solid materials in bulk.
 - 28. **Pinocytosis:** The phenomenon in which cell takes in liquid materials in drops.
 - 29. **Plasmolysis:** The shrinking of cell due to loss of water.
 - 30. **Plastid:** The membrane-bound organelles in plants and many protists.
 - 31. **Reticulum:** The second compartment of the stomach of a ruminant in which folds of the mucous membrane form hexagonal cells.
 - 32. **Ribosome:** Tiny granular structures in cell; either floating freely in the cytoplasm or bound to the endoplasmic reticulum; involved in protein synthesis.
 - 33. **Semi-permeable:** The structure that allows a very few molecules to cross it and checks the majority of molecules to cross.
 - 34. **Tissue:** The group of similar cells, performing the same job.
 - 35. **Turgor pressure:** The pressure of the internal water on cell wall.

MULTIPLE CHOICE QUESTIONS

- 1. Which of these clues would tell you whether a cell is prokaryotic or eukaryotic?
 - A. The presence or absence of a cell wall
 - B. Whether or not the cell is partitioned by internal membranes
 - C. The presence or absence of ribosomes
 - D. Whether or not the cell contains DNA
- 2. There are _____ micrometers (um) in one millimeter (mm).
 - A. 10 B. 100 C. 1000 D. 1/1000
- 3. The plasma membrane does all of these except _____.
 - A. Contains the hereditary material
 - B. Acts as a boundary or border for the cytoplasm
 - C. Regulates passage of material in and out of the cell
 - D. Functions in the recognition of self

BIOLOGY NOTES FOR 9TH CLASS

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4. Which of these materials is not a component of the plasma membrane?
A. Lipids B. Carbohydrates
C. Proteins D. DNA
5. Cells walls are found in these organisms, except for which all lack cell walls?
A. Plants B. Animals
C. Bacteria D. Fungi
6. The _____ is a major component of plant cell walls.
A. Chitin B. Peptidoglycan
C. Cellulose D. Cholesterol
7. Plant cells have _____ and _____ which are not present in animal cells.
A. Mitochondria, chloroplasts
B. Cell membranes, cell walls
C. Chloroplasts, nucleus
D. Chloroplasts, cell wall
8. The _____ is the membrane enclosed structure in eukaryotic cells that contains the DNA of the cell.
A. Mitochondrion B. Chloroplast
C. Nucleolus D. Nucleus
9. Ribosomes are constructed in the _____.
A. Endoplasmic reticulum B. Nucleoid
C. Nucleolus D. Nuclear pore
10. Rough endoplasmic reticulum is the area in a cell where _____ are synthesized.
A. Polysaccharides B. Proteins
C. Lipids D. DNA
11. Smooth endoplasmic reticulum is the area in a cell where _____ are synthesized:
A. Polysaccharides B. Proteins
C. Lipids D. DNA
12. The mitochondrion functions in _____.
A. Lipid storage B. Protein synthesis
C. Photosynthesis D. Cellular respiration
13. The thin extensions of the inner mitochondrial membrane are known as _____.
A. Cristae B. Matrix
C. Thylakoids D. Stroma
14. The chloroplast functions in _____.
A. ATP synthesis B. Protein synthesis
C. Photosynthesis D. DNA replication
15. Which of these cellular organelles have their own DNA?
A. Chloroplast B. Nucleus
C. Mitochondrion D. All of these

BIOLOGY NOTES FOR 9TH CLASS

ANSWERS:

1. B	2. C	3. A	4. D	5. B
6. C	7. D	8. D	9. C	10. B
11. C	12. D	13. A	14. C	15. D

MULTIPLE CHOICE QUESTIONS

- The non-living and strong component of the cell, located outside the cell membrane, in plants, fungi, prokaryotes and many protists is said to be:**
A. Mitochondrion
B. Cell wall
C. Chloroplast
D. Cell Membrane
- The hollow and cylindrical organelles present in the cells of animals and many unicellular organisms:**
A. Chloroplast
B. Lipids
C. Centriole
D. Mitochondrion
- The green plastids found in plants and many protists; involved in photosynthesis is called:**
A. Chloroplast
B. Cristae
C. Matrix
D. Cellulose
- The plastids with pigments of bright colors; present in flower petals, fruits etc.**
A. Matrix
B. Cristae
C. Cellulose
D. Chromoplast
- Animal tissue that supports and binds other tissues:**
A. Epithelial tissue
B. Connective tissue
C. Muscle tissue
D. Nervous tissue
- The semi-viscous and semi-transparent substance present between the plasma membrane and the nuclear envelope:**
A. Chloroplast
B. Centriole
C. Cytoplasm
D. Lysome
- The movement of molecules from an area of their higher concentration to the area of lower concentration:**
A. Vacuole
B. Permeable membrane
C. Turgor Pressure
D. Diffusion
- The network of channels that extends from plasma membrane to the nuclear envelope:**
A. Smooth Endoplasmic Reticulum
B. Rough Endoplasmic Reticulum
C. Endoplasmic reticulum
D. Golgi apparatus

BIOLOGY NOTES FOR 9TH CLASS

9. **Animal tissue that covers the outside of the body and lines organs and cavities:**
A. Epithelial tissue
B. Muscle tissue
C. Connective tissue
D. Nervous tissue
10. **The movement of the molecules from higher to lower concentration with the help of transport proteins:**
A. Passive transport
B. Pinocytosis
C. Facilitated diffusion
D. Plasmolysis
11. **The solution in which more solute is present:**
A. Hypertonic solution
B. Isotonic solution
C. Hypotonic solution
D. Binary Solution
12. **The solution in which less solute is present:**
A. Binary Solution
B. Hypertonic solution
C. Hypotonic solution
D. Isotonic solution
13. **The solutions which has equal concentrations of solutes:**
A. Binary Solution
B. Hypertonic solution
C. Hypotonic solution
D. Isotonic solution
14. **The colourless plastids in the cells of those plant parts where food is stored:**
A. Centriole
B. Leucoplast
C. Chloroplast
D. Cytoplasm
15. **The single-membrane bound organelles having strong digestive enzymes:**
A. Cytoplasm
B. Centriole
C. Leucoplast
D. Lysosome
16. **Part of the cytoskeleton; made of actin proteins:**
A. Microfilament
B. Mitochondrion
C. Microtubule
D. Organelle
17. **Part of the cytoskeleton; made of tubulin proteins:**
A. Mitochondrion
B. Lysosome
C. Microtubule
D. Microfilament
18. **The double membrane-bounded structure in eukaryotes; involved in cellular respiration:**
A. Microfilament
B. Mitochondrion
C. Microtubule
D. Ribosome
19. **The movement of water molecules from a solution of lesser solute concentration to a solution of higher solute concentration, across a semi-permeable membrane:**
A. Osmosis
B. Passive transport
C. Plasmolysis
D. Turgor
20. **The movement of materials without any expenditure of energy:**
A. Active transport
B. Phagocytosis
C. Passive transport
D. Osmosis
21. **The phenomenon in which cell takes in solid materials in bulk:**
A. Phagocytosis
B. Plasmolysis
C. Plastid
D. Pinocytosis

BIOLOGY NOTES FOR 9TH CLASS

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22. The phenomenon in which cell takes in liquid materials in drops:
 A. Plastid B. Pinocytosis
 C. Plasmolysis D. Pinocytosis
 23. The shrinking of cell due to loss of water:
 A. Pinocytosis B. Plasmolysis
 C. Phagocytosis D. Plastid
 24. Animal tissue composed by cells with ability to contract:
 A. Epithelial tissue B. Connective tissue
 C. Nervous tissue D. Muscle tissue
 25. Tiny granular structures in cell; either floating freely in the cytoplasm or bound to the endoplasmic reticulum; involved in protein synthesis:
 A. Cytoplasm B. Centriole
 C. Ribosome D. Chromoplast
 26. The structure that allows a very few molecules to cross it and checks the majority of molecules to cross:
 A. Passive transport B. Semi-permeable
 C. Turgor pressure D. Vacuole
 27. The group of similar cells, performing the same job:
 A. Tissue B. System
 C. Cell D. Organ
 28. The pressure of the internal water on cell wall:
 A. Passive transport B. Pinocytosis
 C. Plasmolysis D. Turgor pressure
 29. A fluid filled organelle, bounded by a single membrane:
 A. Tissue B. Vacuole
 C. Pinocytosis D. Plasmolysis
 30. The membrane-bound organelles in plants and many protists:
 A. Plastid B. Pinocytosis
 C. Phagocytosis D. Ribosome

ANSWERS:

1. B	2. C	3. A	4. D	5. B
6. C	7. D	8. C	9. A	10. C
11. A	12. C	13. D	14. B	15. D
16. A	17. C	18. B	19. A	20. C
21. A	22. D	23. B	24. D	25. C
26. B	27. A	28. D	29. B	30. A

BIOLOGY NOTES FOR 9TH CLASS

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UNIT-05

CELL CYCLE

CHAPTER WISE NOTES

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Q1. State the different types of Cell division.

Ans: There are two main types of cell division i.e., mitosis and meiosis. There are two types of cells in plants and animals. The first one is somatic cell, which divides by mitosis. The second one is a germ line cell, which divides by meiosis.

Q2. Describe the errors in mitosis.

OR

Briefly explain cancerous cells.

Ans: Cancer is a disease of cell cycle. Unlike normal cells of the body, cancer cells do not have a proper functioning cell cycle control system and therefore divide excessively. This excessive growth can result in an abnormal mass of cells called tumour.

Not all tumours are cancerous however. a benign tumour is an abnormal mass of essential normal cells. They always remain at their original site in the body.

Malignant tumour:

Malignant tumors are cancerous. They develop when cells grow uncontrollably. If the cell continue to grow and spread, the disease can become life threatening.

A malignant tumour is cancerous. It is capable of spreading into neighbouring tissues and often to other parts of the body.

Metastasis:

The spread of cancer cells beyond their original site is called *metastasis*.

Q3. Briefly discuss the Errors in Meiosis.

Ans: When chromosomes fail to separate at anaphase it is called nondisjunction. In meiosis chromosomal nondisjunction may occur during first or second meiotic division. The number of chromosomes in man is 46. Due to nondisjunction the number of chromosomes in next generation may be 47 or 45 etc.

Q4. Highlight the importance of cell division in living things.

Ans: The ability of organisms to reproduce their own kind is the one characteristic that best distinguishes living things from non-living things. The continuity of life is based on the reproduction of cell or cell division. As you grow and develop, the cells of your body are constantly dividing. Cells only grow to a certain size then divide.

Cells divide to replace dead or injured cells. Your body is constantly making new blood cells to replace the ones that have died. The cell division is necessary for an organism's growth. The dividing cell is called parent cell and the two new cells formed are called daughter cells.

BIOLOGY NOTES FOR 9TH CLASS

SUMMARY

1. The cell cycle is the period from beginning of one division to the beginning of the next division.
2. Interphase can be divided into the first gap phase (G_1), the chromosomal synthesis (S), and the second gap phase (G_2).
3. During G_1 phase the cell grows and prepares for the S phase. DNA and the chromosomal proteins are synthesized during the S phase.
4. During G_2 phase, protein synthesis increases for cell division.
5. During mitosis, identical chromosomes are distributed to each pole of the cell, and a nuclear membrane forms around each set.
6. During prophase, the chromosomes become visible with the microscope, the nucleolus disappears, the nuclear membrane breaks down, and the mitotic spindle begins to form.
7. During metaphase the duplicated chromosomes each composed of a pair of sister chromatids, line up along the equatorial plan of the cell; the mitotic spindle is complete.
8. During anaphase, the sister chromatids, separates from one another and move to opposite poles of the cell. Each former chromatid is now referred to as a chromosome.
9. During telophase, a nuclear membrane reforms around each set of chromosomes, nucleoli appear, the chromosomes uncoil, and the spindle disappears.
10. During cytokinesis, which generally begins in telophase and therefore overlaps mitosis, the cytoplasm divides to form two individual cells.
11. A diploid cell undergoing meiosis completes two successive cell divisions to give rise to four haploid cells.
12. During meiotic prophase I, the members of a homologous pair of chromosomes undergo synapses and crossing over, during which segments of DNA strands are exchanged between homologous (non-sister) chromatids.
13. The member of each pair of homologous chromosomes separate during meiotic anaphase I and are distributed to different daughter cells.
14. During meiosis II the two chromatids of each chromosome separate and one is distributed to each daughter cell. Each former chromatid is now referred to as chromosomes
15. In sexual reproduction, two haploid sex cells or gametes fuse to form a single diploid zygote. When a zygote is formed each parent contributes to one member of each homologous pair
16. The two principles of cell death are necrosis and apoptosis.

BIOLOGY NOTES FOR 9TH CLASS

EXERCISE

(MCQs)

● **Select the correct answer:**

1. The period of cell cycle between two consecutive divisions is termed as:
A. prophase
B. metaphase
C. telophase
D. interphase
2. Which of the following phases of mitosis is essentially the opposite of prophase in terms of nuclear change?
A. Telophase
B. interphase
C. Metaphase
D. anaphase
3. When do homologous chromosomes pair up?
A. only in mitosis
B. only in meiosis I
C. only in meiosis II
D. in both mitosis & meiosis
4. The arm of the chromosomes are called:
A. chromatin
B. chromatids
C. diploids
D. centromere
5. Cytokinesis is:
A. division of nucleus
B. mitosis
C. division of cytoplasm
D. division of centromeres
6. Meiosis produces:
A. cell with only one homologue of each chromosome pair
B. cells with diploid number of chromosomes
C. an increasing number of cells all with the same DNA complement
D. an increase in the amount of RNA
7. It is difficult to observe chromosomes during interphase because:
A. the DNA has not been replicated
B. they have uncoiled to form long, thin strand
C. they leave the nucleus and dispersed to other parts of the cell
D. homologous chromosomes do not pair up until division starts
8. Crossing over occurs during:
A. telophase
B. interphase
C. metaphase
D. anaphase
9. When do homologous chromosomes pair up?
A. only in mitosis
B. only in meiosis I
C. only in meiosis II
D. in both mitosis and meiosis
10. In which stage of cell cycle, the cell stops dividing:
A. G₁ phase
B. S phase
C. G₂ phase
D. G₀ phase

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ANSWERS:

1. D	2. A	3. B	4. D	5. C
6. A	7. D	8. C	9. B	10. B

SHORT QUESTIONS

Q1. Can you distinguish between?

- (a) mitosis and meiosis
- (b) chromatin and chromosome
- (c) chromosome and chromatids
- (d) centromeres and centrioles
- (e) cytokinesis and karyokinesis
- (f) centromeres and kinetochores
- (g) haploid and diploid number of chromosomes

Ans: (a) mitosis and meiosis:

Meiosis II is similar to mitosis while meiosis I makes the actual difference between these two cell divisions. The following chart describes the main differences between mitosis and meiosis I.

Contrast between mitosis and meiosis:

Mitosis	Meiosis
1. Mitosis takes place in somatic cells.	1. Meiosis takes place in gonads.
2. Mitosis results in 2 daughter cells.	2. Meiosis results in 4 daughter cells.
3. No crossing over takes place	3. Crossing over between homologous chromosomes takes place.
4. Number of chromosomes remain same as in parent cell.	4. Number of chromosomes to half as compared to the parent cell.
5. Daughter cells remain diploid.	5. Daughter cells become from the diploid parent cell.

OR

(Second Answer)

(a) mitosis and meiosis:

Mitosis	Meiosis
1. Takes place in somatic cells	It takes place in germ line cells of sex organs
2. It consists of one division.	It consists of two divisions.
3. Crossing over does not take place during prophase.	Crossing over takes place during prophase I.
4. Centromere divides at metaphase	Centromere does not divide at metaphase I.

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5.	Individual duplicated chromosomes align at the metaphase plate during metaphase.	Paired homologous chromosomes align at metaphase plate during metaphase I
6.	Daughter chromosome move to opposite poles during anaphase.	Homologous chromosomes with two sister chromatids, separate and move to opposite poles during anaphase I
7.	Two diploid daughter cells are formed.	Four haploid daughter cells are formed.
8.	The daughter cells are genetically identical to each other and to the parent cell.	The daughter cells are not genetically identical to each other and to the parent cell.
9.	The number of chromosomes remains constant.	The number of chromosomes becomes half in meiosis.
10.	Mitotic products are usually capable of undergoing additional mitotic divisions.	Meiotic products cannot undergo further divisions.

(b) chromatin and chromosome:

Chromatin	Chromosome
The genetic material in the nucleus is in a loose thread-like form called chromatin.	Chromatin condenses into highly ordered structures called chromosomes.
Chromatin is the usual form of the packaged DNA in the cell.	Chromosome appears at the metaphase of the nuclear division.
Chromatin consists of the unravelled condensed structure of DNA for the purpose of packaging into the nucleus.	Chromosome consists of the highest condensed structure of the DNA doublehelix for the proper separation of the genetic material between daughter cells.

(c) chromosome and chromatids:

Chromosome	Chromatids
Chromatin condenses into highly ordered structures called chromosomes.	A chromatid is an identical half of a duplicated chromosome. After duplication of a chromosome, two identical halves are formed, each of which is called chromatids.
Chromosome appears at the metaphase of the nuclear division.	Chromatids are formed during the interphase and exist until the metaphase of cell division.
Chromosome consists of the highest condensed structure of the DNA double-helix for the proper separation of the genetic material between daughter cells.	Chromatids are two molecules of double-stranded DNA joined together in the center by a centromere. Chromatids have a thin and long fibrous structure

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(d) centromeres and centrioles:

Centromeres	Centrioles
The centromere is a section of DNA (non-coding) that is responsible for the movement of replicated chromosomes to the daughter cells during mitosis and meiosis.	Centrioles are tube like structures that aid in cell division. They generally are found close to the nucleus and are made up of nine tube-like structures that each have three tubules.
The centromere is a small-sized bubble situated in the primary constriction.	It is a cylindrical cell structure composed of a protein tubulin.
Centromere occurs in all eukaryotic cells.	The main function of the centriole is to help with cell division in animal cells.
The number of centromeres in the cell equals the number of chromosomes.	The centrioles help in the formation of the spindle fibres that separate the chromosomes during cell division (mitosis).

(e) cytokinesis and karyokinesis:

Cytokinesis	Karyokinesis
Nuclear division is followed by separation of the cytoplasm into two parts. The process of cytoplasmic division is called cytokinesis.	Karyokinesis, is the partition of the parent cell's nucleus into two daughter nuclei. These two daughter nuclei are genetically identical.
In cytokinesis, metaphase is the second step of the process.	In karyokinesis, metaphase is the initial step of the process.
The cytoplasm, along with the cell membrane and organelles of the parent cell, is distributed in the two daughter cells equally.	The nucleus is divided into two genetically identical nuclei.
Cytokinesis depends on karyokinesis.	Karyokinesis is not dependent on cytokinesis. It can take place in the absence of cytokinesis as well.

(f) centromeres and kinetochores:

Centromeres	Kinetochores
The centromere is a section of DNA (non-coding) that is responsible for the movement of replicated chromosomes to the daughter cells during mitosis and meiosis.	The kinetochore is a type of protein which connects the chromosomes with the spindle microtubules. Spindle microtubules are attached with kinetochore which is assembled on the centromere.
The centromere is a small-sized bubble situated in the primary constriction.	Kinetochore is a disc-shaped protein complex found in the centromere region of the chromosome.

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Centromere occurs in all eukaryotic cells.	Kinetochore that are associated with centromeres have the ability to bind microtubules.
The number of centromeres in the cell equals the number of chromosomes.	The number of bound microtubules to a kinetochore varies with the species.

(g) haploid and diploid number of chromosomes:

Haploid	Diploid
Haploid cells contain only one set of Chromosomes (n).	Diploid, as the name indicates, contains 2 sets of chromosomes (2n).
In the higher organism, such as humans, haploid cells are only used for sex cells.	In the higher organism, such as humans, all other cells beside sex cells are diploid.
Examples of haploid cells are gametes (male or female germ cells).	Examples of diploid cells include blood cells, skin cells and muscle cells. These cells are known as somatic cells.

Q2. Compare the following:

- (a) mitosis and meiosis
- (b) mitosis in animal cell and plant cell
- (c) necrosis and apoptosis
- (d) meiosis II and mitosis

Ans: (a) mitosis and meiosis:

Mitosis	Meiosis
1. Takes place in somatic cells.	It takes place in germ line cells of sex organs
2. It consists of one division.	It consists of two divisions.
3. Crossing over does not take place during prophase.	Crossing over takes place during prophase I
4. Centromere divides at metaphase	Centromere does not divide at metaphase I
5. Individual duplicated chromosomes align at the metaphase plate during metaphase.	Paired homologous chromosomes align at metaphase plate during metaphase I
6. Daughter chromosome move to opposite poles during anaphase.	Homologous chromosomes with two sister chromatids, separate and move to opposite poles during anaphase I
7. Two diploid daughter cells are formed.	Four haploid daughter cells are formed.
8. The daughter cells are genetically identical to each other and to the parent cell.	The daughter cells are not genetically identical to each other and to the parent cell.

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9.	The number of chromosomes remains constant.	The number of chromosomes becomes half in meiosis.
10.	Mitotic products are usually capable of undergoing additional mitotic divisions.	Meiotic products cannot undergo further divisions.

(b) mitosis in animal cell and plant cell:

	Mitosis in Animal cell	Mitosis in Plant cell
1.	Centriole is present and divides into two during early prophase.	Centriole is absent.
1.	Centriole and spindle fibres form mitotic apparatus.	Only spindle fibres form Mitotic apparatus.
2.	Cytokinesis occurs by pinching of the cell membrane in the middle forming a cleavage furrow.	Cytokinesis occurs by the phragmoplast, which separates the two cells.
3.	Cell division occurs in all tissues of the body.	Cell division occurs only in meristematic cells of plants.

(c) necrosis and apoptosis:

	Necrosis	Apoptosis
1.	The death of most of the cells due to disease, injury or failure of the blood supply is called necrosis.	Apoptosis is programmed cell death.
1.	It is premature and accidental death of the cells. Necrosis causes severe cell swelling, cell rupture and breakdown of cell organelles.	The cells in multicellular individual have genetic program of growth, development, reproduction and even death.
2.	When the cell swells and bursts, it releases its toxins, which can damage neighbouring cells and cause inflammation.	Many cells proceed to self-destruction when they complete a prescribed function.
3.	Untreated necrosis can lead to serious injury or even death.	The cells undergoing apoptosis show cell shrinkage and chromatin condensation.
4.	e.g. If blood flow is not restored until one hour later, however, necrosis will occur and many heart cells will die.	e.g. Blebs are irregular buds on cell surface that form apoptotic bodies. Phagocytosis of apoptotic bodies takes place by white blood cells.

(d) meiosis II and mitosis:

	Meiosis II	Mitosis
1.	It is the second part of meiosis and is similar to mitosis.	It takes place in germ line cells of sex organs
2.	It is subdivided into 4 divisions.	It consists of two divisions.

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3.	In prophase II, nucleoli and nuclear envelope disappear and chromatin condenses. Centrioles move to the polar regions and make spindle fibres.	Crossing over takes place during prophase I.
4.	In metaphase II, chromosomes attach with kinetochore spindle fibers and align at the equator of cell.	Centromere does not divide at metaphase I. Paired homologous chromosomes align at metaphase plate during metaphase I
5.	In anaphase II, where centromeres are cleaved and sister chromatids are pulled apart.	Homologous chromosomes with two sister chromatids, separate and move to opposite poles during anaphase I
6.	The sister chromatids are now called sister chromosomes, and they are pulled toward opposing poles.	Four haploid daughter cells are formed. The daughter cells are not genetically identical to each other and to the parent cell.
7.	Telophase II is marked with uncoiling of chromosomes into chromatin.	The number of chromosomes becomes half in meiosis.
8.	Nuclear envelopes reform, cleavage or cell wall formation eventually produces a total of 4 daughter cells, each with a haploid set of chromosomes	Meiotic products cannot undergo further divisions.

Q3. Write the significance of:

(a) **Mitosis**

(b) **Meiosis**

Ans: (a) Significance of Mitosis:

The main function of mitosis is to maintain same number of chromosomes in each daughter cells. Following are the significance of the mitosis.

- i. **Genetically Identical Cells:** The genetic information i.e., DNA is regularly and equally distributed to the daughter cell. The diploid number (2n) of chromosomes is maintained in the cell, and thus maintains its genetic stability.
- ii. **Growth:** It is the basis of growth and development in multicellular organisms, because body cells or somatic cells are formed by mitosis.
- iii. **Replacement of Cells:** Healing of wound and replacement of damaged cells is done by mitosis: (a) dead or worn-out red blood cells and white blood cells are constantly replaced, (b) When skin is cut, new skin cells grow over the cut and replace the skin cells that are damaged.
- iv. **Asexual Reproduction:** Mitosis is a means of asexual reproduction in many organisms. For example, Hydra is a tiny multicellular organism that reproduces by either sexual or asexual means. Hydra reproduces asexually by mitosis through budding. In plants natural vegetative propagation occurs

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by means of: creeping stem e.g., grasses, sweet potato, strawberry;
underground buds, e.g. ginger, potato, onion, etc.

(b) Significance of Meiosis:

Meiosis is necessary to maintain the number of chromosomes as well as to produce variations in the next generation.

Maintenance of the chromosome number in next generation:

Meiosis takes place during sexual reproduction to maintain the number of chromosomes in the next generation. In animals, germ line cells undergo meiosis to produce haploid gametes. Male and female gametes unite to form diploid zygote, which undergoes repeated mitosis and develops into a new diploid organism. In plants, germ line cells produce haploid spores by meiosis, which produce haploid gametes. The gametes combine to form diploid zygote. Many haploid fungi and protozoans produce haploid gametes through mitosis.

Production of variations in next generation:

The chromosomes undergo crossing over during meiosis. The daughter cells i.e., gametes have genetic variations. When gametes fuse and form zygote, it is genetically different from both parents. Thus, meiosis provides variations in next generation.

Q4. How does meiosis contribute to genetic recombination?

Ans: Crossing-over of the chromosomes during meiosis I leads to genetic recombination of different alleles of genes on the same chromosome. When genes are located near each other on a chromosome, they act as if they are linked and parental allele combinations are more often than not inherited together by the grandchildren. Parental homologous chromosomes exchange segments during crossing over to produce recombinant chromosomes.

Q5. What kind of a life cycle includes a multicellular haploid stage? Can haploid cells divide by mitosis or by meiosis?

Ans: Gametes develop in the multicellular haploid gametophyte (from the Greek phyton, "plant"). Fertilization gives rise to a multicellular diploid sporophyte, which produces haploid spores via meiosis. This type of life cycle is called a haplodipontic life cycle

Meiosis is essential for sexual reproduction. In humans, diploid gamete-mother cells or germ line cells undergo meiosis to produce haploid gametes. Male and female gametes unite to form diploid zygote, which undergoes repeated mitosis and develops into a new diploid human. Many haploid fungi and protozoans produce haploid gametes through mitosis. Plants' life cycle shows alternation of generations.

The cells of diploid sporophyte generation undergo meiosis to produce haploid spores, which grow into haploid gametophyte generations. Gametophyte generation produces haploid gametes through mitosis. The gametes combine to produce diploid zygote. Zygote undergoes repeated mitosis to become diploid sporophyte.

Haploid cell can be divided by mitosis. Both haploid and diploid cells can undergo mitosis. When a haploid cell undergoes mitosis, it produces two genetically identical haploid daughter cells; when a diploid cell undergoes mitosis, it produces two genetically identical diploid daughter cells.

Mitosis can occur both in diploid and haploid cells. the main function of mitosis is to make copies of cells for growth and regeneration.

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Q6. Why do cells of a tissue need to undergo mitosis?

Ans: Mitosis produces new cells, and replaces cells that are old, lost or damaged. Mitosis is a way of making more cells that are genetically the same as the parent cell. It plays an important part in the development of embryos, and it is important for the growth and development of our bodies as well.

Healing of wound and replacement of damaged cells is done by mitosis:

- (a) Dead or worn-out red blood cells and white blood cells are constantly replaced.
- (b) When skin is cut, new skin cells grow over the cut and replace the skin cells that are damaged.

Q7. Can haploid cells divide?

Ans: Yes, When a haploid cell undergoes mitosis, it produces two genetically identical haploid daughter cells.

EXTENSIVE QUESTIONS

Q1. Describe cell cycle with the help of labelled diagram.

Ans: Cell Cycle:

A cell cycle is a series of events from the time a cell is produced until it has produced daughter cells. The duration of the cell cycle depends on the type of cell.

Phases of Cell Cycle:

There are two main phases of cell cycle, a) interphase, b) mitotic phase. Interphase is the period between two cell divisions. Mitotic phase is the phase of division.

Interphase:

Most of the cell cycle is spent in interphase. Chromosomes duplicate during this period; many cell parts are made and the cell does most of its growth. Typically, interphase lasts for at least 90% of the total time required for the cell cycle. Interphase has three main sub-phases.

G₁ Phase:

The first sub -phase, is the period before DNA synthesis begins. In G₁ phase, the cell increases proteins production, increases the number of many of its organelles, such as mitochondria and ribosomes, and grows in size. Towards the end of G₁ phase there is an increased activity of enzymes required for DNA synthesis.

S Phase:

It is the synthetic phase. Following G₁ phase is the sub-phase S, in which DNA synthesis actually occurs. At the beginning of the S phase, each chromosome is single. At the end of this phase, after DNA replication, each chromosome consists of two sister chromatids.

G₂ Phase:

It is last sub-phase before cell division. In this phase increased protein synthesis occurs for the production of spindle fibres.

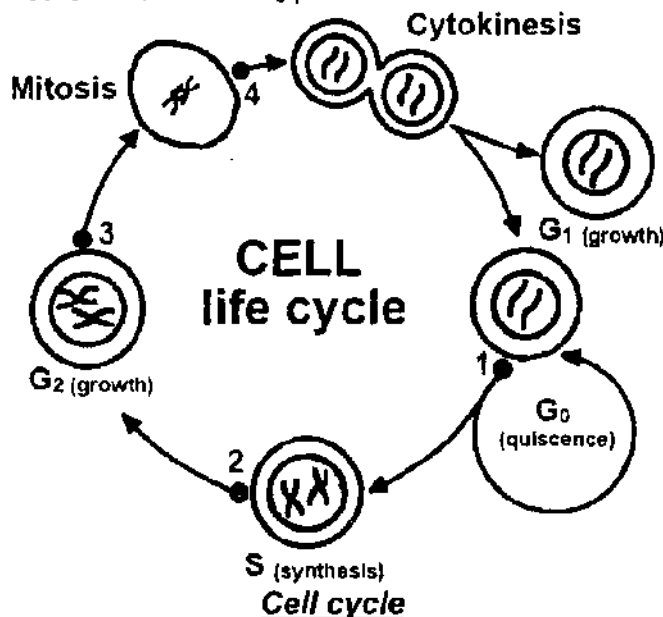
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M Phase:

In this phase the cell is divided into two daughter cells. This phase is called mitosis.

G₀ Phase:

Cells that have stopped dividing are in G₀ phase. In multicellular eukaryotes, cells enter G₀ phase from G₁. Some cells of liver and kidneys enter the G₀ phase temporarily. While neurons remain in G₀ phase for indefinite period. Other cells, such as epithelial cells do not enter G₀ phase.



Q2. Draw the diagram of mitosis in an animal cell. Write the main features of mitosis in brief. What is the significance of mitosis in your life?

Ans: Mitosis:

Mitosis occurs in the somatic cells of animals and plants. It is the division of a cell to form two new cells that are exactly alike. Mitosis can be defined as "The division of the cell in such a manner that the chromosomes number remains same in the daughter cells as in the parent cells".

Main feature of Mitosis / Phases of Mitosis:

Mitosis is divided into two major phases; Karyokinesis and Cytokinesis.

(a) Karyokinesis: Division of Nucleus

Karyokinesis is studied in four stages, but actually it is a continuous process:

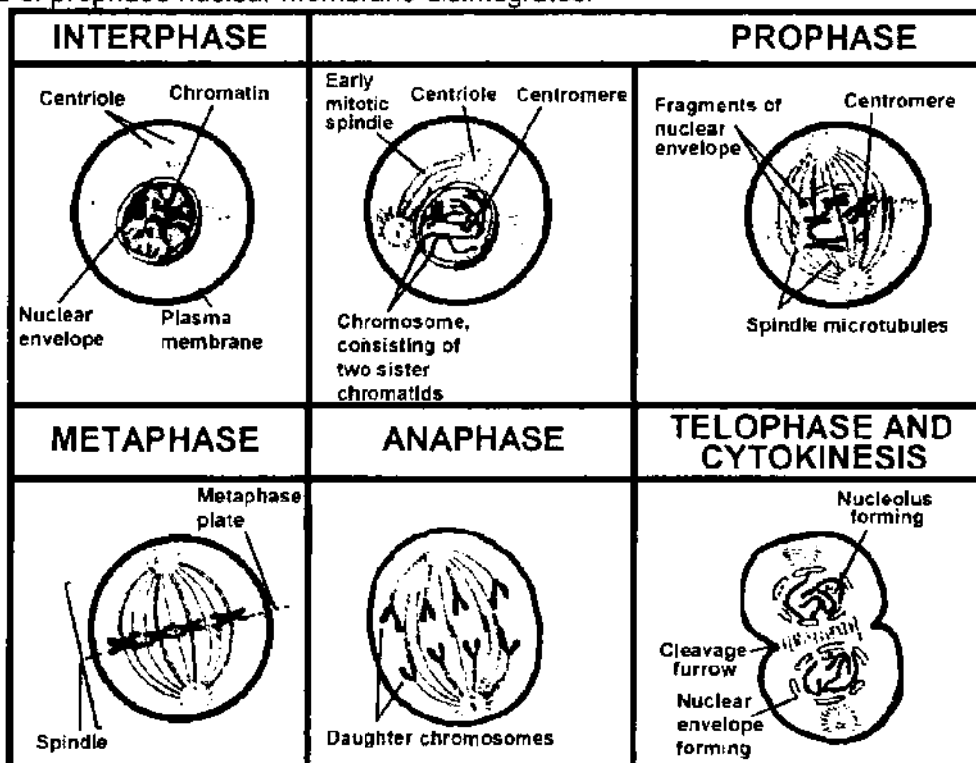
- | | |
|---------------|---------------|
| i. Prophase | ii. Metaphase |
| iii. Anaphase | iv. Telophase |

i. Prophase:

Early in the prophase, the centrioles divide and the two centriole move to opposite poles of the cell. In the beginning of prophase, the chromosomes are not visible as they are in the form of fine thread like structure called chromatin. The chromatin begins to shorten, thicken and coil by a process called condensation. It

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results in the appearance of chromosomes. Spindle fibres are formed between the centriole; thus, mitotic apparatus is established. Nucleolus disappears and to the end of prophase nuclear membrane disintegrates.



Mitosis in animal cell

ii. **Metaphase:**

Spindle fibres become attached with centromere of chromosome and arrange them on equator of the cell forming metaphase plate.

iii. **Anaphase:**

In anaphase spindle fibres contract, sister chromatid of each chromosome separates and begin to move to the opposite poles. Finally, they reach the respective poles.

iv. **Telophase:**

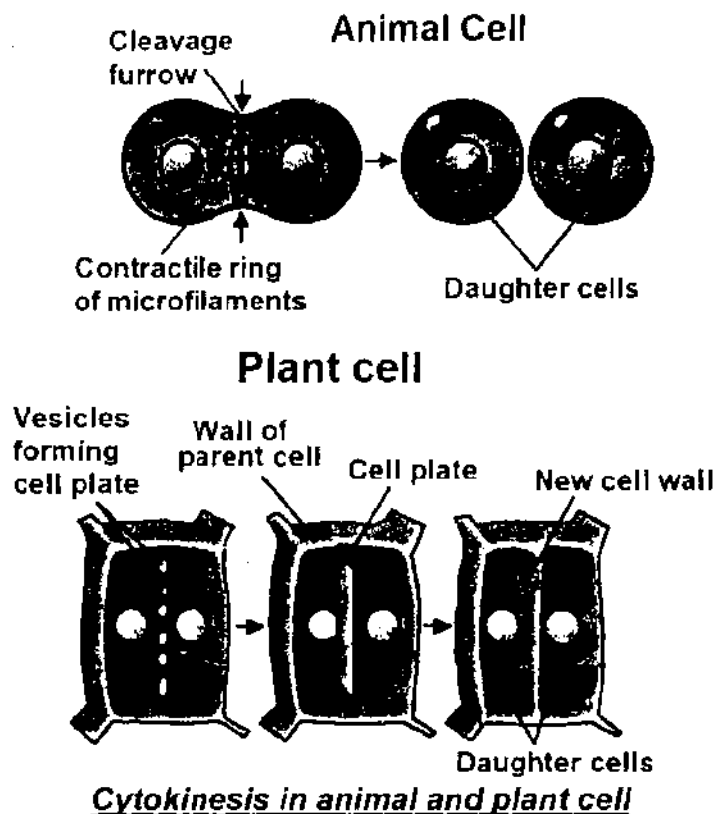
Spindle fibres disintegrate. Chromosome uncoil to form chromatin fibre. Nuclear membrane is formed around each set of chromatin fibres at both poles. Nucleoli reappear.

(b) **Cytokinesis:**

Nuclear division is followed by separation of the cytoplasm into two parts. The process of cytoplasmic division is called cytokinesis. In animal cells this separation is achieved by pinching of the cell membrane in the middle forming, a cleavage furrow. In plant cells, vesicles derived from Golgi apparatus move to the equator and fuse to form phragmoplast. Phragmoplast grows outward and fuse with the cell membrane and parental cell wall. The contents of the phragmoplast form middle lamella. Each cell forms its primary wall on its side.

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Significance of Mitosis:

The main function of mitosis is to maintain same number of chromosomes in each daughter cells. Following are the significance of the mitosis.

i. Genetically Identical Cells

The genetic information i.e., DNA is regularly and equally distributed to the daughter cell. The diploid number ($2n$) of chromosomes is maintained in the cell, and thus maintains its genetic stability.

ii. Growth

It is the basis of growth and development in multicellular organisms, because body cells or somatic cells are formed by mitosis.

iii. Replacement of Cells

Healing of wound and replacement of damaged cells is done by mitosis: (a) dead or worn-out red blood cells and white blood cells are constantly replaced, (b) When skin is cut, new skin cells grow over the cut and replace the skin cells that are damaged.

iv. Asexual Reproduction

Mitosis is a means of asexual reproduction in many organisms. For example, Hydra is a tiny multicellular organism that reproduces by either sexual or asexual means. Hydra reproduces asexually by mitosis through budding. In plants natural vegetative propagation occurs by means of: creeping stem e.g., grasses, sweet potato, strawberry; underground buds, e.g., ginger, potato, onion, etc.

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Q3. Describe meiosis in an animal cell. Elaborate your answers with the help of labelled diagram.

Ans: Meiosis:

Meiosis is the process by which one diploid (2n) eukaryotic cell divides to generate four haploid (1n) daughter cells. Diploid means the cells in which chromosomes are in pairs (homologous pairs) while haploid means the cells with half the number of chromosomes i.e. chromosomes are not in the form of pairs.

The word meiosis comes from the Greek 'meioun', meaning "to make smaller", since it results in a reduction in chromosome number.

Hypothesis of August Weismann:

August Weismann proposed the hypothesis that *"there must be a kind of cell division in which the chromosome number is halved"*. Both somatic cells and germ line cell are diploid (2n) i.e., have full number of chromosomes e.g., in man the diploid number of chromosomes is 46. When a germ line cell undergoes division, it produces cells with half of the number of chromosomes. Cells having half number of chromosomes are called haploid (n), e.g., the haploid number of chromosomes in man is 23. This process of division is called meiosis.

Main feature of Meiosis / Phases of Meiosis:

Meiosis is a continuous process. It can be described by dividing it into two stages i.e., meiosis I and meiosis II. Meiosis I is subdivided into prophase I, metaphase I, anaphase I and telophase I.

Meiosis II is further subdivided into prophase II, metaphase II, anaphase II and telophase II.

Interphase I:

The DNA duplicates by replication process. Each chromosome consists of two sister chromatids.

The First Meiotic Division:

Prophase I:

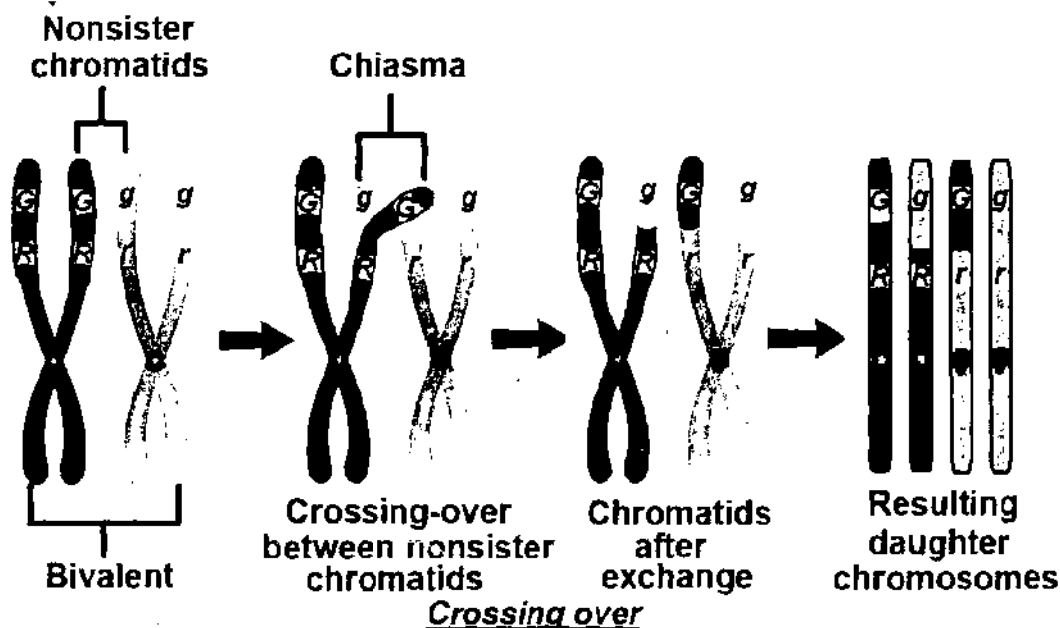
It is a lengthy process of meiosis. Due to condensation of chromatin, chromosomes become apparent and distinct. In the cell there are two of each type of chromosome. The similar chromosomes are called homologous chromosomes. The homologous chromosomes begin to pair length wise with their homologue. The process of pairing is called synapsis. Each pair of synapsed chromosome consists of four chromatids, two centromeres and is called a tetrad or bivalent.

Crossing over:

The chromatids of the Nonsister chromatids homologous pair may cross each other and the point of crossing is X shaped. It is called chiasma. Chromosome segment is exchanged between the two non-sister chromatids of homologous chromosomes at the chiasmata and is called crossing over.

The paired homologous chromosomes begin to separate by repelling. The nucleoli disappear and the nuclear membrane disintegrates. Centrioles move to opposite poles and form spindle fibres.

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Metaphase I:

Spindle fibres attach with the centromere of chromosome but they bind only to one of each centromere i.e., two spindle fibres from opposite poles attach with a pair of chromosomes. The pair of homologous chromosomes align on equator forming the metaphase plate.

Anaphase I:

The spindle fibres become shorter. The chromosomes that are attached to the spindles are also pulled towards each pole. When the shortening of spindle fibre is completed, each pole has half set of chromosomes, consisting of one member of each homologous pairs.

Telophase I:

Spindle fibres disintegrate. Chromosomes uncoil to form chromatin fibre. Nuclear membrane forms around each set of chromatin fibres at both poles. Nucleoli reappear.

By cytokinesis two haploid cells are formed.

Interphase II:

DNA does not duplicate in interphase II. Interphase II is very brief. Each of the two cells resulting from meiosis I progress into meiosis II.

The Second Meiotic Division:

Meiosis II is simply a mitotic division. It occurs to separate the sister chromatids as in mitosis.

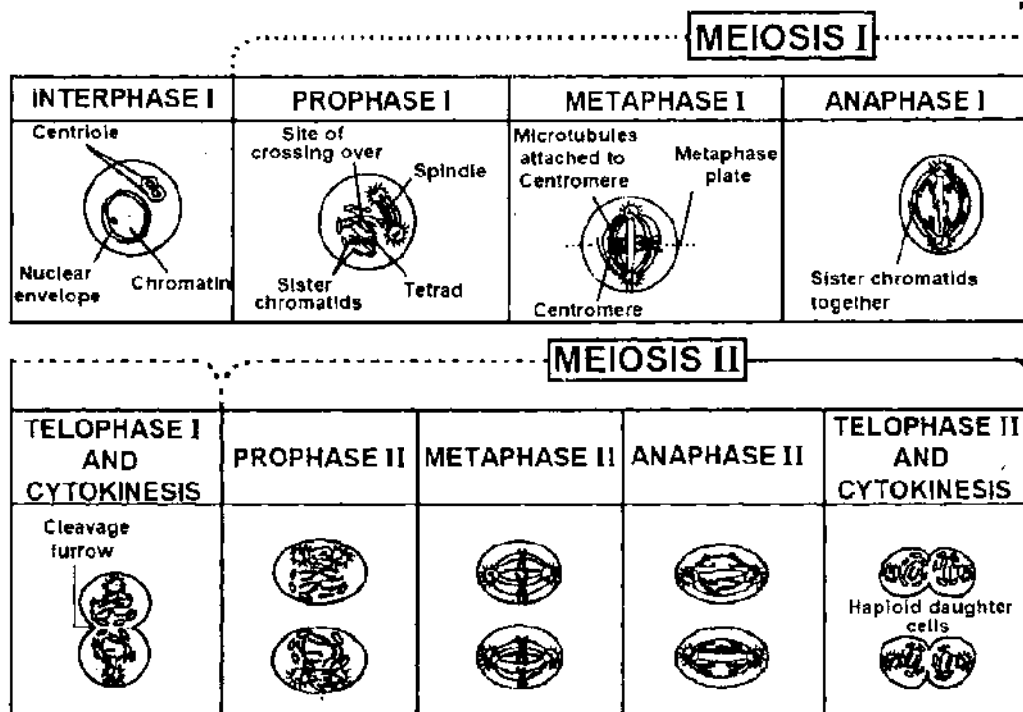
Prophase II:

Chromatin condenses, nucleoli and nuclear membrane disappear. Centrioles move to opposite poles and make spindle fibres.

Metaphase II:

The chromosomes line up in a single row at the equator of the cell. Here a random distribution of chromosomes takes place.

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Meiosis in an animal cell

Anaphase II:

The centromere divides; as a result, the two chromatids are separated. As each chromatid is now a separate structure, they are called chromosomes. Chromosomes move to opposite pole.

Telophase II:

The nuclei are reconstructed in the typical manner. Each nucleus now contains haploid set of chromosomes.

Q4. Write the differences between mitosis and meiosis.

Ans: Differences between mitosis and meiosis:

	Mitosis	Meiosis
1.	Takes place in somatic cells	It takes place in germ line cells of sex organs
2.	It consists of one division.	It consists of two divisions.
3.	Crossing over does not take place during prophase.	Crossing over takes place during prophase I
4.	Centromere divides at metaphase	Centromere does not divide at metaphase I
5.	Individual duplicated chromosomes align at the metaphase plate during metaphase.	Paired homologous chromosomes align at metaphase plate during metaphase I
6.	Daughter chromosomes move to opposite poles during anaphase.	Homologous chromosomes with two sister chromatids, separate and move to opposite poles during anaphase I.

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7.	Two diploid daughter cells are formed.	Four haploid daughter cells are formed.
8.	The daughter cells are genetically identical to each other and to the parent cell.	The daughter cells are not genetically identical to each other and to the parent cell.
9.	The number of chromosomes remains constant.	The number of chromosomes becomes half in meiosis.
10.	Mitotic products are usually capable of undergoing additional mitotic divisions.	Meiotic products cannot undergo further divisions.

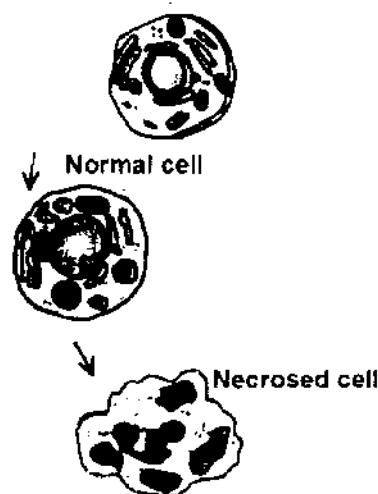
Q5. Compare necrosis and apoptosis.

Ans: Comparison of Necrosis and Apoptosis:

There are two patterns of cell death; necrosis and apoptosis.

Necrosis:

The death of most of the cells due to disease, injury or failure of the blood supply is called necrosis. It is premature and accidental death of the cells. Necrosis causes severe cell swelling, cell rupture and breakdown of cell organelles. When the cell swells and bursts, it releases its toxins, which can damage neighbouring cells and cause inflammation. Untreated necrosis can lead to serious injury or even death. For example, If the blood supply to a segment of the heart is cut off 10 to 15 minute and then restored, the cells of the cardiac muscle experience injury but can recover and function normally. If blood flow is not restored until one hour later, however, necrosis will occur and many heart cells will die.



Cell death by Necrosis

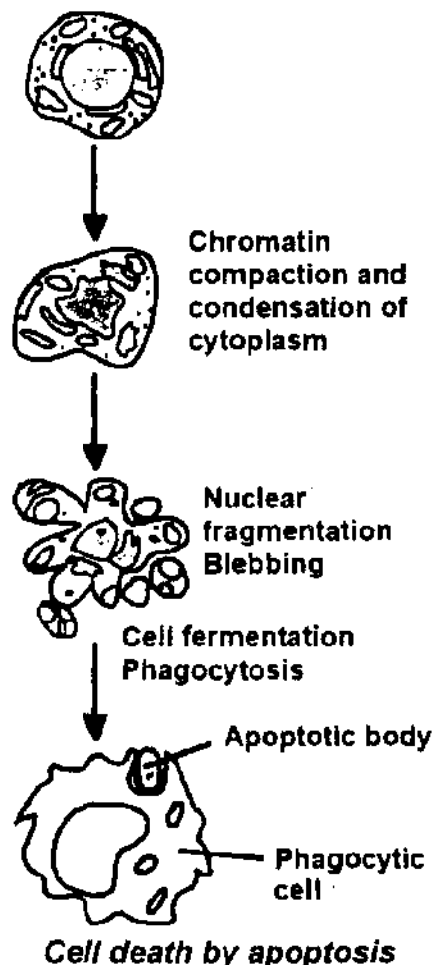
Apoptosis:

Apoptosis is programmed cell death. The cells in multicellular individual have genetic program of growth, development, reproduction and even death. Many cells proceed to self-destruction when they complete a prescribed function. The cell death by self-destruction is called apoptosis. The cells undergoing apoptosis show cell shrinkage and chromatin condensation. Blebs are irregular buds on cell surface that form apoptotic bodies. Phagocytosis of apoptotic bodies takes place by white blood cells.

Examples of apoptosis:

- i. As a homeostatic mechanism to maintain cell population in tissues.
- ii. As a defence mechanism such as in immune reaction.
- iii. When cells are damaged by disease
- iv. In aging.
- v. During embryonic development the growth of the cells between fingers that are no longer needed undergo apoptosis.

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Cell death by apoptosis

OR

(Second Answer)

1	Apoptosis is a 'programmed' cell death.	Necrosis is a 'premature' cell death.
3	Genetically Controlled.	Not Genetically controlled.
6	Apoptotic cell death usually do not require any treatment.	Necrotic cell death are not natural and always require proper treatment.
7	Apoptotic cell deaths are usually beneficial to the organisms.	Necrotic cell deaths are always detrimental to the organisms.
8	Apoptotic cell death is initiated by self-generated signals from inside or outside the cells.	Necrotic cell death always occurs after signals from external agents such as fungal or bacterial toxins.
9	Shrinkage of cells occurs during apoptosis.	Swelling of cells occurs during necrosis.
11	Chromatin condensation is a hallmark of apoptosis.	No chromatin condensation occurs during necrosis.

BIOLOGY NOTES FOR 9TH CLASS

12	Nucleus get fragmented.	Nucleus get disorganized.
15	No inflammation occurs in the surrounding tissues.	Cause severe inflammation in the surrounding tissues.
16	Cell undergoing apoptosis are actively take part in cell death pathway.	Cells undergoing necrosis do not take part in any events in the death pathway.
17	An active process hence require energy from ATP molecules.	A passive process and do not require ATP.
20	The integrity of lysosomes are preserved in apoptotic cell death.	The integrity of lysosomes are compromised during necrotic cell death, lysosome leakage occurs.
21	The integrity of mitochondria usually lost during the initial phases of apoptosis.	The integrity of mitochondria usually maintained during the initial phases of necrotic cell death.
23	Activation and participation of many Caspase enzymes are involved in apoptosis.	No Caspase enzymes are involved in necrosis.
25	DNA fragmentation is pre-lytic (before cell lysis) in apoptosis.	DNA fragmentation is post lytic (after cell lysis) in necrosis.
28	pH of the cells changes to acidic during apoptosis.	There is no change in the pH of the cells during necrosis.
30	Usually apoptotic cell death occurs in individual cells.	Usually a group of cells undergo necrotic cell death.

THE TERMS TO KNOW

- Anaphase:** The phase of mitosis and meiosis in which each kinetochore fibre pulls toward the originating centrosome and divides the sister chromatids (in mitosis and meiosis-II) or divides the homologous pair (in meiosis-I).
- Apoptosis:** The programmed cell death during which cell membrane makes blebs which break from the cell and are phagocytosed by other cells.
- Benign:** Not malignant; (For tumors) which remain in their original location.
- Budding:** Making mass of cells on the surface.
- Cell cycle:** The series of events from the time a cell is produced until it completes mitosis and produces new cells.
- Chiasmata:** The complexes formed between the non-sister chromatids of homologous chromosomes during meiosis-I.
- Crossing over:** The exchange of segments between the non-sister chromatids of homologous chromosomes during meiosis-I.
- G₀ phase:** The phase of the cell cycle in which a cell remains quiescent and does not divide or prepare for division

BIOLOGY NOTES FOR 9TH CLASS

10. **G₂ phase:** The phase of interphase in which the cell prepares proteins for the production of spindle fibres.
11. **Homologous chromosomes:** Morphologically similar chromosomes; with genes for the same characters.
12. **Interphase:** The phase of cell cycle between two successive divisions.
13. **Karyokinesis:** The division of the nucleus.
14. **Kinetochores:** The complex made of proteins that are attached with the centromere of the chromosomes.
15. **M phase:** Mitotic phase of the cell cycle.
16. **Malignant:** Not benign; (For tumors) which break from the site of their production and invade other tissues.
17. **Metaphase:** The phase of cell division in which two kinetochore spindles from opposite sides attach with each chromosome (in mitosis and meiosis-II) or with homologous pair (in meiosis-I) and metaphase plate is formed.
18. **Metaphase plate:** The metaphase plate is a plane or region that is approximately equidistant from the two poles of a dividing cell.
19. **Mitosis:** The cell division in which each two daughter cell has the same number of chromosomes as were present in the parent cell.
20. **Necrosis:** The phenomenon of accidental cell or tissue death.
21. **Non-sister chromatids:** Non-sister chromatids are ones who are different and are located on different chromosomes.
22. **Phragmoplast:** The cell plate formed during cytokinesis in plant cells.
23. **Prophase:** The first phase of mitosis in and meiosis which the chromatin condenses and spindles are formed; crossing over occurs during the prophase of meiosis-I.
24. **S phase:** The phase in interphase during which the chromosomes are duplicated i.e. new chromatids are formed.
25. **Sister chromatids:** The chromatids of the same chromosome.
26. **Spindle:** The fibres at which chromosomes attach during cell division.
27. **Synapsis:** The phenomenon of the pairing of homologous chromosomes.
28. **Telophase:** The last phase of karyokinesis during which nuclear envelopes is reformed and chromosomes uncoil to form chromatin.

MULTIPLE CHOICE QUESTIONS

1. In which stage of the cell cycle each chromosome is duplicated and so it consists of two chromatids?



2. If you observe a cell like this one, what phase of mitosis is it?
- | | | | |
|-------------------|--------------|------|-------------------|
| A. G ₁ | S | C. M | D. G ₂ |
| A. Anaphase | B. Telophase | | |
| C. Metaphase | D. Prophase | | |

BIOLOGY NOTES FOR 9TH CLASS

- =====
3. During which phase of mitosis spindles are formed?
A. G₂ B. Interphase
C. Prophase D. Metaphase
4. In which stage of the cell cycle, the cell is preparing to begin DNA replication?
A. G₁ B. G₂
C. S D. M
5. Which of the following features of cell division are very different for animal and plant cells?
A. Metaphase B. Anaphase
C. Telophase D. Cytokinesis
6. Prior to cell division, each chromosome replicates or duplicates its genetic material. The products are connected by a centromere and are called;
A. Sister chromosomes
B. Homologous chromosomes
C. Non-sister chromatids
D. Sister chromatids
7. The process of mitosis ensures that;
A. Each new cell is genetically different from its parent
B. Each new cell receives the proper number of chromosomes
C. Cells will divide at the appropriate time
D. DNA is replicated without errors
8. Cytokinesis in a plant cell is characterized by;
A. The equal division of homologous chromosomes
B. A pinching off of the cell membrane to divide the cell
C. The formation of a cell plate in the cytoplasm
D. The movement of the chromosomes from the metaphase plate
9. Which of the following is unique to mitosis and not a part of meiosis I?
A. Homologous chromosomes pair forming bivalents
B. Homologous chromosomes cross over
C. Chromosome pairs are broken during anaphase
D. Chromatids separate during anaphase
10. Which event distinguishes meiosis from mitosis?
A. Condensation of chromosomes
B. Loss of the nuclear membrane
C. Formation of metaphase plate
D. Pairing of homologous chromosomes
11. In which stage of the cell cycle most cells spend their lives?
A. Prophase B. Metaphase
C. Interphase D. Telophase
12. Which of the following distinguishes meiosis from mitosis?
A. the chromosome number is reduced
B. chromosomes undergo crossing over
C. the daughter cells are genetically different from the parent cell
D. All of the above

BIOLOGY NOTES FOR 9TH CLASS

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13. For mitosis, the chromosomes of cell duplicated during interphase.
When do the chromosomes duplicate for meiosis?
- A. before meiosis I B. before meiosis II
C. during meiosis I D. do not duplicate
14. Find the correct statement.
- A. Homologous chromosomes from pairs during mitosis
B. Chromosomes do not replicate in the interphase preceding Meiosis I
C. Homologous chromosome from pairs during meiosis but not mitosis
D. Spindles are not required during meiosis
15. What reason would you suggest for the fact that the total DNA content daughter cell is reduced during meiosis?
- A. Chromosomes do not duplicate during the interphase before meiosis I
B. Chromosomes do not duplicate between meiosis I and II
C. Half of the chromosomes from each gamete are broken
D. Sister chromatids separate during anaphase of meiosis I

ANSWERS:

1. B	2. A	3. C	4. A	5. D
6. D	7. B	8. C	9. D	10. D
11. C	12. D	13. A	14. C	15. B

MULTIPLE CHOICE QUESTIONS

1. Between two mitotic divisions, the DNA of the cells is duplicated.
When does get duplicated during meiosis I and meiosis II?
- A. The DNA is duplicated between meiosis I and meiosis II
B. The DNA is not duplicated during meiosis I and meiosis II
C. The DNA is duplicated during meiosis I
D. The DNA is duplicated during meiosis II
2. Which one is the difference between mitosis and meiosis I?
- A. Homologous chromosome pairs synapse during mitosis
B. Chromosomes do not replicate in the interphase preceding meiosis
C. Homologous chromosome pairs synapse during meiosis but not mitosis
D. Spindles composed of microtubules are not required during meiosis
3. The complexes formed between the non-sister chromatids of homologous chromosomes during meiosis-I
- A. Monosomy B. Karyokinesis
C. Chiasmata D. Prophase
4. A type of mitosis in which spindles are formed inside the nucleus:
- A. Closed mitosis B. Open Mitosis
C. Apoptosis D. Chiasmata

BIOLOGY NOTES FOR 9TH CLASS

- =====
5. The exchange of segments between the non-sister chromatids of homologous chromosomes during meiosis-I:
A. Monosomy B. Chiasmata
C. Karyokinesis D. Crossing over
6. The phase of the cell cycle in which a cell remains quiescent and does not divide or prepare for division:
A. G₁ phase B. G₀ phase
C. G₂ phase D. M phase
7. The phase of interphase in which the cell increases its supply of proteins, makes new organelles, grows in size and makes enzymes for the next phase:
A. G₀ phase B. G₂ phase
C. G₁ phase D. S phase
8. The phase of interphase in which the cell prepares proteins for the production of spindle fibres:
A. G₀ phase B. G₁ phase
C. M phase D. G₂ phase
9. Morphologically similar chromosomes; with genes for the same characters:
A. Homologous chromosomes B. Phragmoplast
C. Trisomy D. Chiasmata
10. The phase of cell cycle between two successive divisions:
A. Anaphase B. Interphase
C. Apoptosis D. Prophase
11. Not benign; (For tumors) which break from the site of their production and invade other tissues:
A. Tubulin B. Malignant
C. Trisomy D. Monosomy
12. The phase of cell division in which two kinetochore spindles from opposite sides attach with each chromosome (in mitosis and meiosis-II) or with homologous pair (in meiosis-I) and metaphase plate is formed:
A. Anaphase B. Interphase
C. Apoptosis D. Metaphase
13. The arrangement of chromosomes on spindle fibers along the equator of the cell:
A. Metaphase plate B. Anaphase
C. Apoptosis D. Interphase
14. The cell division in which each two daughter cell has the same number of chromosomes as were present in the parent cell:
A. Anaphase B. Prophase
C. Mitosis D. Apoptosis
15. The condition in which there is one less chromosome than the usual 2N number:
A. Monosomy B. Anaphase
C. Interphase D. Prophase

BIOLOGY NOTES FOR 9TH CLASS

16. The mitosis in which the spindle fibers are formed outside the nuclear envelope:
A. Anaphase
B. Prophase
C. Open mitosis
D. Interphase
17. The cell plate formed during cytokinesis in plant cells:
A. Phragmoplast
B. Anaphase
C. Apoptosis
D. Synapsis
18. The first phase of mitosis in and meiosis which the chromatin condenses and spindles are formed; crossing over occurs during the prophase of meiosis-I:
A. Anaphase
B. Prophase
C. Prophase
D. Interphase
19. The phase in interphase during which the chromosomes are duplicated i.e. new chromatids are formed:
A. M phase
B. S phase
C. G phase
D. G₁ phase
20. The chromatids of the same chromosome:
A. Sister chromatids
B. spindle
C. tubulin
D. Synapsis
21. The fibres at which chromosomes attach during cell division:
A. tubulin
B. Spindle
C. Synapsis
D. Chromatids
22. The phenomenon of the pairing of homologous chromosomes:
A. Synapsis
B. tubulin
C. Chromatids
D. Spindle
23. The last phase of karyokinesis during which nuclear envelopes is reformed and chromosomes uncoil to form chromatin:
A. Anaphase
B. Metaphase
C. Telophase
D. Interphase
24. The proteins that make the centrioles and the spindle fibres:
A. Anaphase
B. Chromatids
C. Trisomy
D. Tubulin

ANSWERS:

1. C	2. C	3. C	4. A	5. D
6. B	7. C	8. D	9. A	10. B
11. B	12. D	13. A	14. C	15. A
16. C	17. A	18. C	19. B	20. A
21. B	22. A	23. C	24. D	

BIOLOGY NOTES FOR 9TH CLASS

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UNIT-06

ENZYMES

CHAPTER WISE NOTES

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Q1. Briefly explain the working of enzyme.

Ans: Most of the essential reactions taking place in the body must occur quickly and precisely for a cell to survive. Enzymes work as biological catalyst and control all the chemical reactions making up the metabolism.

Substrates:

Enzymes work on substances called **substrates**.

Active site:

The reaction takes place on a part of the surface of enzyme called the **active site**. The substrates are the molecules entering into chemical reactions.

Products:

The substrates undergo a chemical change resulting in new bonding arrangement between the molecules. The changed substrates are called **products**.

SUMMARY

=====

1. The sum of all the chemical reactions that occur within a cell or organisms is called metabolism.
2. An enzyme is a biological catalyst which greatly increases the speed of a chemical reaction without being consumed.
3. An enzyme lowers the activation energy necessary to get a reaction going.
4. An active site of enzyme is a three dimensional region where substrates come into close contact and there by react more rapidly.
5. Most enzymes need a co-factor. Most inorganic co-factors are metal ions. A co-enzyme is an organic co-factor such as NAD, and co-enzyme A. FAD is the prosthetic group for enzymes.
6. Enzymes work best at specific temperature and optimum pH.
7. Specificity of enzymes is due to the shape of its active site.

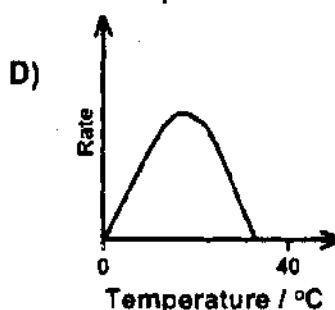
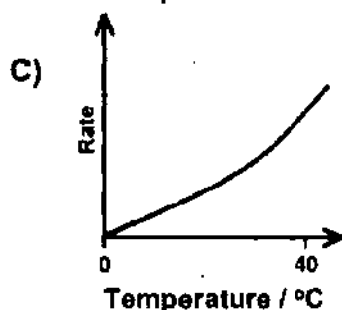
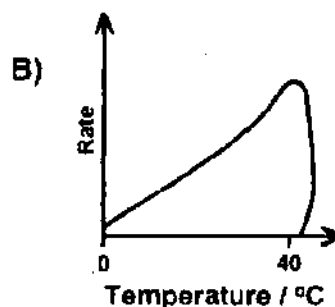
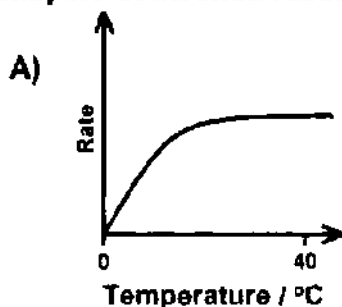
BIOLOGY NOTES FOR 9TH CLASS

EXERCISE

(MCQs)

● **Select the correct answer:**

1. The catalytic activity of an enzyme is restricted to its small portion called:
A. active site
B. passive site
C. binding site
D. intermediate site
2. Hydrolysis of starch occurs with the help of:
A. sucrose
B. amylase
C. cellulose
D. lipase
3. Which is true about enzyme?
A. all enzymes are not protein
B. all enzymes are vitamins
C. all enzymes are proteins
D. all proteins are enzyme
4. Lock and key hypothesis of enzyme action supports that:
A. active sites are flexible
B. active sites are rigid
C. active site efficiency increases
D. active site can change its shape
5. Which graph shows how temperature affects the rate of an enzyme-controlled reaction?



BIOLOGY NOTES FOR 9TH CLASS

- =====
6. **The sum of all the chemical reactions in a cell is called:**
 - A. metabolism
 - B. anabolism
 - C. catabolism
 - D. intracellular space
 7. **What is true about cofactors?**
 - A. break hydrogen bond in proteins
 - B. help facilitate enzyme activity
 - C. increase activation energy
 - D. are composed of proteins
 8. **Enzymes are chemically made up of:**
 - A. Proteins
 - B. Carbohydrates
 - C. Fats
 - D. Nucleic acids
 9. **Change in pH can alter the active site by affecting the:**
 - A. ionization of amino acids
 - B. Shape of substrate
 - C. ionization of cofactor
 - D. Ionization of coenzyme
 10. **The catalytic region on enzyme recognizes and binds the substrate and carries the reaction. This region is called as:**
 - A. cofactor
 - B. activator
 - C. inhibitor
 - D. active site

ANSWERS:

1. A	2. B	3. C	4. B	5. B
6. A	7. B	8. A	9. A	10. D

SHORT QUESTIONS

- Q1. Write the difference between:
- (a) catalyst and enzyme
 - (b) anabolism and catabolism
 - (c) intracellular and extracellular enzymes.
- Ans: (a) catalyst and enzyme:

Catalyst	Enzyme
A catalyst is a substance that increase rate of chemical reactions.	Enzymes are biocatalyst that increases the speed of biochemical reaction in an organism.
A very small amount of catalysts is required for a reaction.	A very small quantity of an enzyme is capable of catalysing a huge amount of substrate
Catalysts decreases the activation energy of a reaction by introducing an alternative pathway to the reaction.	Many enzymes can work together in a specific order making metabolic pathways.
Catalysts react with the substrate to form a temporary intermediate at a low energy state.	Enzymes can act only on one substrate and it will not act on a different substrate.

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(b) anabolism and catabolism:

Anabolism	Catabolism
Reactions which build complex molecules from simpler molecules are called anabolic reactions or anabolism.	Reactions which break down complex molecules into simpler molecules, are called catabolic reactions or catabolism.
Energy is released in catabolism	Energy is utilized in anabolism.
Example: amino acids becoming polypeptides (proteins), glucose becoming glycogen, fatty acids becoming triglycerides.	Example: proteins becoming amino acids, proteins becoming glucose, glycogen becoming glucose, or triglycerides becoming fatty acids.

(c) intracellular and extracellular enzymes:

Intracellular enzymes	Extracellular enzymes
Intracellular enzymes are the enzymes that are synthesized and retained within the cell for the internal cellular use.	Extracellular enzymes are the enzymes that are synthesized by the cell and secreted to the outside for the external use.
Intracellular enzymes are found inside the cell; in the cytoplasm, nucleus, chloroplast, mitochondria etc.	Extracellular enzymes are found in duodenum, mouth etc.
Intracellular enzymes work inside the cell.	Extracellular enzymes work outside the cell.
Examples of intracellular enzymes are DNA polymerase, RNA polymerase, and ATP synthetase etc.	Examples of extracellular enzymes are digestive enzymes, salivary amylase, trypsin, lipase etc.

Q2. Why enzymes are called biological catalyst?

Ans: Enzymes are proteins that catalyze a chemical reaction in our body. They function as a catalyst that speeds up the reaction by lowering the activation energy. The enzyme accelerates a chemical reaction without changing its equilibrium, so it is called as a biocatalyst. They increase the rate of biochemical reactions in an organism.

Q3. What are the characteristics of enzymes?

Ans: Enzymes and their characteristics:

Enzymes have following characteristics.

i. Enzymes are Proteins:

All Enzymes are protein in nature except ribozyme. They are made up of amino acids.

ii. Enzymes Increase Rate of Reaction:

In the absence of enzymes, it may take months or years to complete the reactions. The enzymes speed up the reactions millions of times faster as compared to non-catalysed reaction.

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iii. Enzymes are required in Small Quantity:

Enzymes are not changed in chemical reaction. So they can be used over and over again. Thus, a very small quantity of an enzyme is capable of catalysing a huge amount of substrate.

iv. Enzymes are Specific:

Enzymes can act only on one substrate and it will not act on a different substrate. For example, amylase will only act on starch and not on proteins or fats.

v. Enzymes Require Co-factor:

Many enzymes require a non-protein helper called **cofactor** for their proper working. There are three types of cofactors: activator, prosthetic group and coenzyme.

vi. Regulation of enzyme production and activity:

Enzyme production can be increased or decreased by a cell according to requirements. Enzyme activity can be regulated by inhibitors or activators.

vii. Enzymes make metabolic pathway:

Many enzymes can work together in a specific order making metabolic pathways. Metabolic pathway is a series of connected chemical reactions that lead to the conversion of a substance into final product.

Q4. Name the factors affecting enzyme activity.

Ans: Factors affecting enzyme activity:

The activity of an enzyme is affected by following conditions:

- | | |
|------------------------------|-----------------|
| i. pH | ii. Temperature |
| iii. Substrate concentration | |

Q5. How enzymes are named?

Ans: Enzymes are named by adding the suffix -ase to the name of the substrate that they modify (i.e., urease and tyrosinase), or the type of reaction they catalyze (dehydrogenase, decarboxylase). The International Union of Biochemistry and Molecular Biology assigns each enzyme a name and a number to identify them.

Q6. At what temperature human enzymes act the best?

Ans: Temperature for human enzymes:

Enzymes are biological catalysts which accelerate chemical reactions in organisms. Optimum temperature is the temperature at which enzyme activity is maximum. In humans, this temperature is 37.5°C that is same as the normal body temperature.

Q7. Give examples of cofactor.

Ans: Vitamins, minerals, and ATP are all examples of cofactors. ATP functions as a cofactor by transferring energy to chemical reactions

Q8. What happens to an enzyme when it is heated up to 100°C?

Ans: Optimum temperature for human enzymes is 36°C to 38°C. If enzyme heated up to 100°C, the temperature get increased above optimum temperature, then a decrease in the rate of reaction occurs due to denaturation i.e., breakdown at high temperature.

If temperature is reduced to below freezing point, enzymes are inactivated but not denatured. They will regain their catalytic activity when higher temperatures are restored.

BIOLOGY NOTES FOR 9TH CLASS

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Q9. Which protein digesting enzyme functions in acidic medium?

Ans: Pepsin is a stomach enzyme that serves to digest proteins found in ingested food. Gastric chief cells secrete pepsin as an inactive zymogen called pepsinogen. Parietal cells within the stomach lining secrete hydrochloric acid that lowers the pH of the stomach. A low pH (1.5 to 2) activates pepsin.

Q10. Why is less energy needed for reaction to occur when an enzyme is present?

Ans: Enzymes are biological catalysts. Catalysts lower the activation energy for reactions. The lower the activation energy for a reaction, the faster the rate. Thus enzymes speed up reactions by lowering activation energy.

Q11. Why are enzymes required in small amounts?

Ans: Enzymes are biological catalysts which speed up chemical reactions in our body without being used up. In a reaction, a small presence of a catalyst is enough to lower down the activation energy of the reaction, so not much is needed to start the reaction.

Q12. Why are enzyme specific and why can't each one speed up many different reactions?

Ans: Each enzyme is specific to a chemical reaction it will affect because each enzyme contains an active site which is an area of an enzyme that has specific shape and size and differs from one enzyme to another.

The active site is shaped in a way that only a specific substrate can fit into the active site of an enzyme.

EXTENSIVE QUESTIONS

Q1. Define enzyme and describe their characteristics and specifications.

Ans: Enzymes:

Proteins which speed of chemical reactions inside living organisms, by minimizing the activation energy are known as enzymes.

Characteristics of enzymes:

Enzymes have following characteristics

i. **Enzymes are Proteins:**

All Enzymes are protein in nature except ribozyme. They are made up of amino acids.

ii. **Enzymes Increase Rate of Reaction:**

In the absence of enzymes, it may take months or years to complete the reactions. The enzymes speed up the reactions millions of times faster as compared to non-catalysed reaction.

iii. **Enzymes are required in Small Quantity:**

Enzymes are not changed in chemical reaction. So they can be used over and over again. Thus, a very small quantity of an enzyme is capable of catalysing a huge amount of substrate.

BIOLOGY NOTES FOR 9TH CLASS

iv. **Enzymes are Specific:**

Enzymes can act only on one substrate and it will not act on a different substrate. For example, amylase will only act on starch and not on proteins or fats.

v. **Enzymes Require Co-factor:**

Many enzymes require a non-protein helper called **cofactor** for their proper working.

● **Types of cofactors:**

There are three types of cofactors: activator, prosthetic group and coenzyme.

● **Activator:**

Many enzymes require ions such as zinc, iron, copper and chlorides etc. For example, salivary amylase activity is increased in the presence of chloride ions.

● **Prosthetic group:**

If the cofactor is tightly bound to the enzyme on permanent basis it is known as prosthetic group. Prosthetic groups are organic molecules. For example haem group.

● **Coenzyme:**

When the cofactor is detachable organic molecule it is called **coenzyme**. **Examples** of co-enzymes are **NAD** (nicotinamide adenine dinucleotide), coenzyme A and vitamin A.

vi. **Regulation of enzyme production and activity:**

Enzyme production can be increased or decreased by a cell according to requirements. Enzyme activity can be regulated by inhibitors or activators.

vii. **Enzymes make metabolic pathway:**

Many enzymes can work together in a specific order making metabolic pathways. Metabolic pathway is a series of connected chemical reactions that lead to the conversion of a substance into final product.

Specifications of Enzymes:

Enzymes are specific. It means one enzyme can act only on particular substrate. It cannot act on any other substance.

Examples of specificity of enzymes:

The examples of specificity of enzymes are:

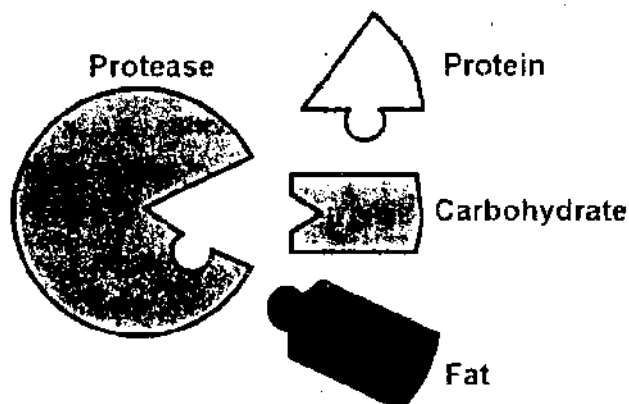
- (a) **Proteases** break up proteins into amino acid.
- (b) **Lipase** breaks down only lipids.
- (c) **Amylase** acts on starch.

Specificity of Enzyme is due to its shape:

The figure shows an enzyme protease. There are three-substrates: protein, carbohydrate and fat. We can guess that it is the shape of the active site of an enzyme, which exactly fits the shape of protein, but would not fit the shape of carbohydrate or fat. So, it is the shape of active site that decides what substances it will combine with.

BIOLOGY NOTES FOR 9TH CLASS

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Specificity of enzyme (protease) is due to the shape of active site

Q2. Explain metabolism with examples.

Ans: Metabolism:

The sum of all the chemical reactions going on within the cells is known as **metabolism**.

"Metabolism refers to a series of chemical reactions that occur in a living organism to sustain life."

Metabolism is the total amount of the biochemical reactions involved in maintaining the living condition of the cells in an organism. All living organisms require energy for different essential processes and for producing new organic substances.

The metabolic processes help in growth and reproduction and help in maintaining the structures of living organisms. The organisms respond to the surrounding environment due to metabolic activities. All the chemical reactions occurring in the living organisms from digestion to transportation of substances from cell to cell require energy.

Metabolic Process:

There are two types of metabolic process Catabolism and Anabolism

(a) Catabolism:

This process is mainly involved in breaking down larger organic molecules into smaller molecules. This metabolic process releases energy.

(b) Anabolism:

This process is mainly involved in building up or synthesizing compounds from simpler substances required by the cells. This metabolic process requires and stores energy.

Metabolism is related to nutrition and the existence of nutrients. Bioenergetics describes the metabolism as the biochemical pathway through which the cells obtain energy. One of the major aspects is the energy formation.

Metabolic pathways:

The flow of energy within an organism consists of a long series of coupled reactions. These chains of reactions are called metabolic pathways. All the metabolic pathways taking place in our body work to help us to survive.

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Example of metabolism:

Metabolic reactions may be categorized as catabolic – the breaking down of compounds (for example, the breaking down of glucose to pyruvate by cellular respiration); or anabolic – the building up (synthesis) of compounds (such as proteins, carbohydrates, lipids, and nucleic acids).

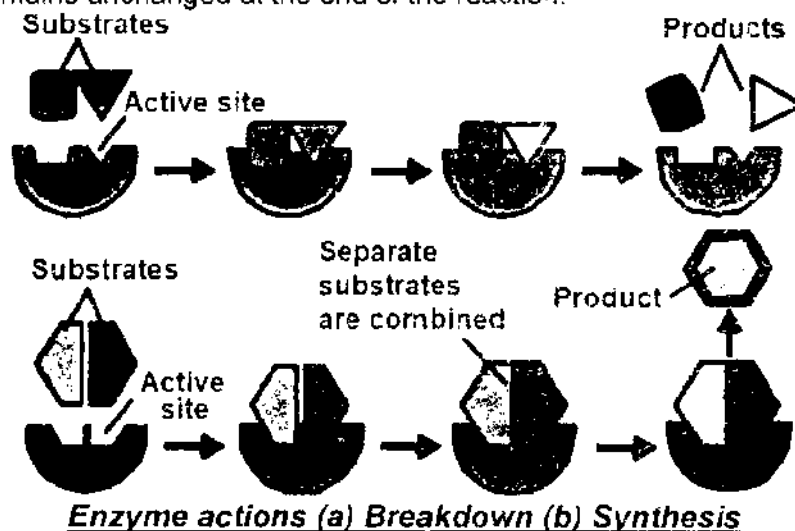
Q3. Prove that enzymes are proteins and are specific in function.
Explain that specificity of enzyme is due to its shape.

Ans: Mechanism of Enzyme Action:

Enzymes are specific in function because different enzymes have differently shaped active sites.

Enzymes are proteins comprised of amino acids linked together in one or more polypeptide chains. This sequence of amino acids in a polypeptide chain is called the primary structure. This, in turn, determines the three-dimensional structure of the enzyme, including the shape of the active site. Enzymes are highly specific to their substrates.

Most enzymes are far larger molecules than the substrates they act on. The site where the substrate binds with enzyme is known as the active site, which has a specific shape. The active site is usually only a very small portion of the enzyme. The enzyme combines with its substrate to form enzyme substrate complex. Once a reaction has occurred, the complex breaks up into products and enzyme. The enzyme remains unchanged at the end of the reaction.



Enzymes are Proteins:

All Enzymes are protein in nature except ribozyme. They are made up of amino acids.

Enzymes are Specific:

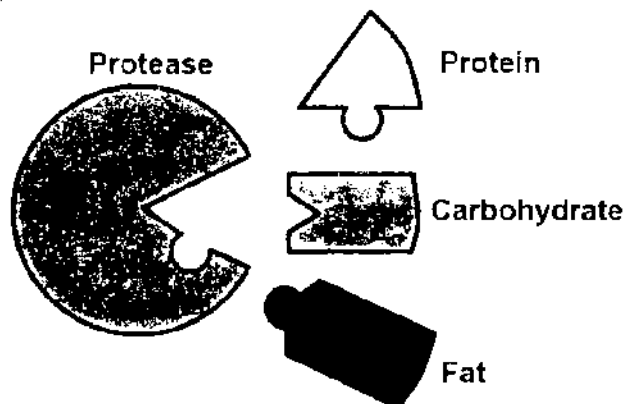
Enzymes can act only on one substrate and it will not act on a different substrate. For example, amylase will only act on starch and not on proteins or fats.

Specificity of Enzyme is due to its shape:

The figure shows an enzyme protease. There are three-substrates: protein, carbohydrate and fat. You can guess that it is the shape of the active site of an

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enzyme, which exactly fits the shape of protein, but would not fit the shape of carbohydrate or fat. So, it is the shape of active site that decides what substances it will combine with.



Specificity of enzyme (protease) is due to the shape of active site

Q4. Describe that enzymes require co-factor.

Ans: Enzymes Require Co-factor:

Many enzymes require cofactors to function properly. Cofactors can be considered as "helper molecules" that assist enzymes in their action. Cofactors can be ions or organic molecules called coenzymes. Small quantities of these vitamins must be consumed in order for our enzymes to function correctly.

Some enzymes require the addition of another non-protein molecule to function as an enzyme. These are known as cofactors, and without these enzymes remain within the inactive "apoenzyme" forms. Cofactors can either be ions, such as zinc and iron ions, or organic molecules, such as vitamins or vitamin-derived molecules.

Many enzymes require a non-protein helper called **cofactor** for their proper working.

Types of cofactor:

There are three types of cofactors: activator, prosthetic group and coenzyme.

(i) Activator:

Many enzymes require ions such as zinc, iron, copper and chlorides etc. For example, salivary amylase activity is increased in the presence of chloride ions.

(ii) Prosthetic group:

If the cofactor is tightly bound to the enzyme on permanent basis it is known as prosthetic group. Prosthetic groups are organic molecules. For example haem group.

(iii) Coenzyme:

When the cofactor is detachable organic molecule it is called **coenzyme**. Examples of co-enzymes are **NAD** (nicotinamide adenine dinucleotide), coenzyme A and vitamin A.

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Q5. What is energy of activation? Explain with reference to enzyme.

Ans: Energy of activation:

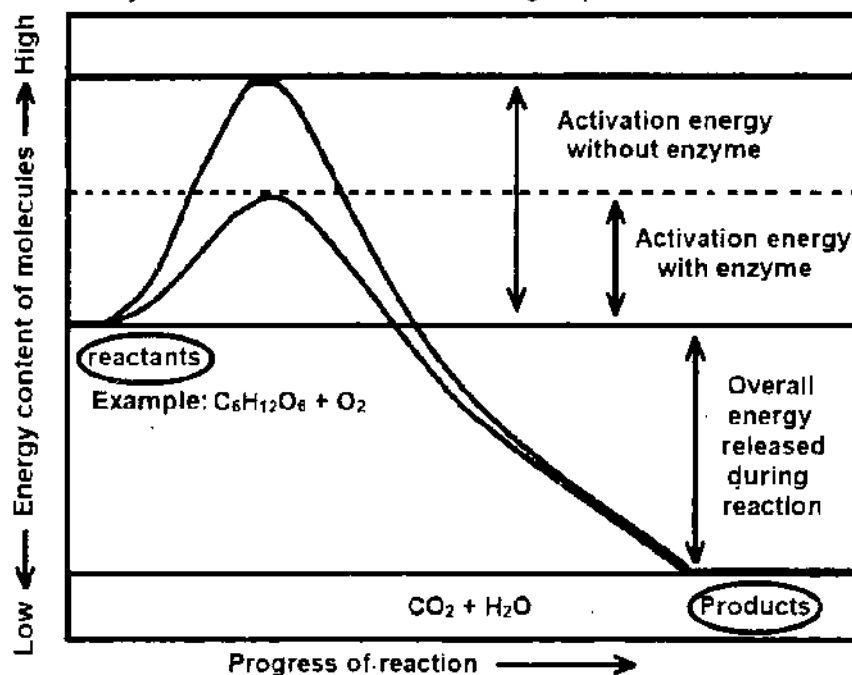
The energy needed to start or activate the reaction is called **energy of activation**. At body temperature of living organisms, it is not possible to provide required activation energy for all the metabolic processes.

Function of enzymes to lower energy of activation:

Enzymes lower the activation energy so that these reactions can take place at body temperature.

The ways enzymes lower the activation energy are:

- Enzymes may change the shape of the substrate.
- Some enzymes alter the charge distribution on substrate.
- Enzymes may position substrates together in the proper orientation.
- Some enzymes add or remove functional groups on the substrate.



Energy of activation: High activation of energy (blue line) without enzymes. Low activation of energy (red line) with enzymes.

Q6. What happens to enzymes when you increase or decrease:

- Temperature
- pH
- Substrate concentration.

Ans:

(a) Temperature:

Heat increases molecular motion. Thus, the molecules of the substrates and enzymes move more quickly, so the rate of reaction increases.

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Optimum temperature:

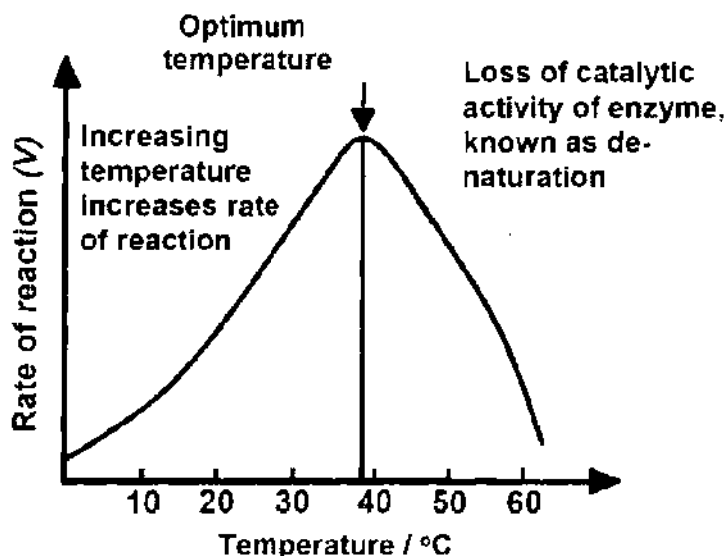
The temperature, at which an enzyme catalysed reaction happens fastest, is called optimum temperature. Different enzymes have different optimum temperature e.g., optimum temperature for human enzymes is 36°C to 38°C.

Effect of increase in temperature on enzymes:

If the temperature is increased above optimum temperature, then a decrease in the rate of reaction occurs due to denaturation i.e., breakdown at high temperature.

Effect of decrease in temperature on enzymes:

If temperature is reduced to below freezing point, enzymes are inactivated but not denatured. They will regain their catalytic activity when higher temperatures are restored.



Effect of temperature on the rate of enzyme-controlled reaction

(b) pH:

pH is the hydrogen ion concentration $[H^+]$ in a solution. Enzymes are affected by pH of medium.

Optimum pH:

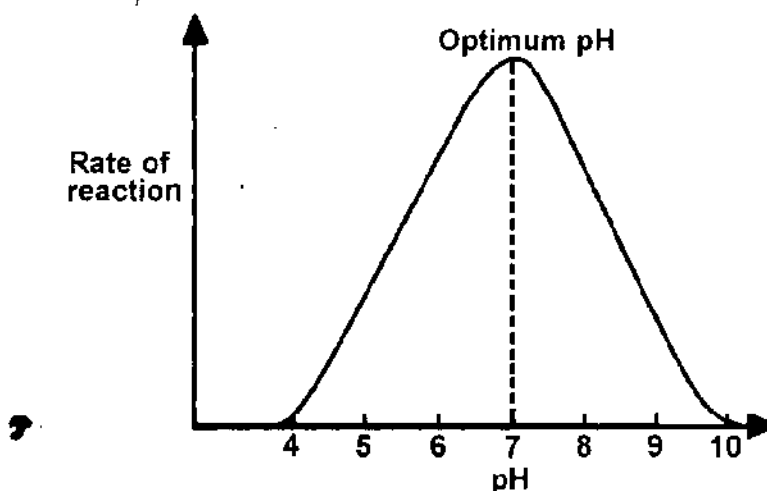
Each kind of enzyme works best at a particular pH, which is called optimum pH. In the stomach enzymes work in acidic medium and in intestine other enzymes work in alkaline medium. For example, enzyme pepsin in the stomach has an optimum pH of about 2.

Effect of increase and decrease in pH on enzymes:

If the pH is much higher or lower than its optimum pH, then an enzyme is denatured i.e., it loses its shape.

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Effect of pH on the rate of enzyme-controlled reaction

(c) Substrate Concentration:

Substrate concentration is the amount of substrate present that can be turned into product and is most commonly measured in molarity (moles per liter). The concentration of substrates is often used to measure enzyme activity, which is based on the rate of a reaction (product formed over time)

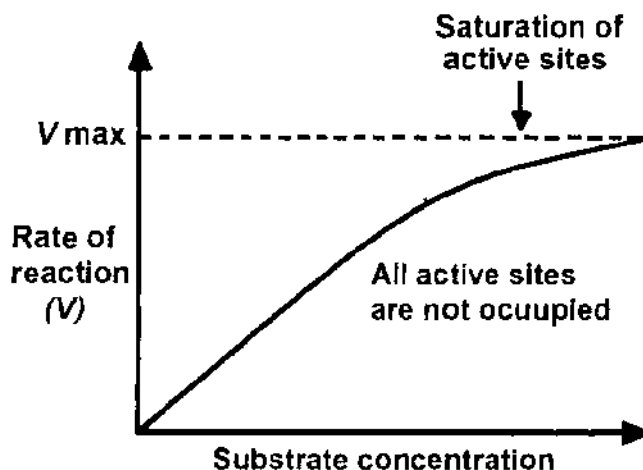
For a given enzyme concentration as the substrate concentration increases the rate of reaction increases up to a limit.

Effect of increase in substrate concentration on enzymes:

A further increase in substrate concentration does not increase the rate any further. This is because at any given moment the active sites of all the enzyme molecules are saturated by substrate molecules.

Effect of decrease in substrate concentration on enzymes:

If the concentration of the substrate is low, increasing its concentration will increase the rate of the reaction. An increase in the amount of enzyme will increase the rate of the reaction (provided sufficient substrate is present).



Effect of substrate concentration on the rate of enzyme controlled reaction

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Q7. Only the related key can open the lock. How this fact is true for enzyme? Explain with examples.

Ans: Lock and Key Model:

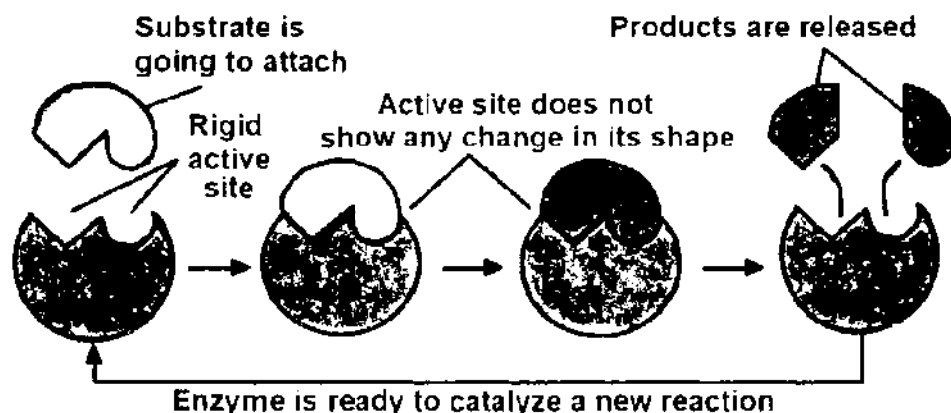
Enzymes are highly specific. They must bind to a specific substrate before they can catalyze a chemical reaction. At present, there are two models, which attempt to explain enzyme specificity: (1) lock-and-key model and (2) induced fit model. In lock-and-key model, the enzyme-substrate interaction suggests that the enzyme and the substrate possess specific complementary geometric shapes that fit exactly into one another.

Like a key into a lock, only the correct size and shape of the substrate (the key) would fit into the active site (the key hole) of the enzyme (the lock).

As for the induced fit model suggested by Daniel Koshland in 1958, it suggests that the active site continues to change until the substrate is completely bound to the active site of the enzyme, at which point the final shape and charge is determined. Unlike the lock-and-key model, the induced fit model shows that enzymes are rather flexible structures.

The lock and key model theory first postulated by Emil Fischer in 1894 shows the high specificity of enzymes. However, it does not explain the stabilization of the transition state that the enzymes achieve.

Emil Fischer proposed the lock and key model of enzyme action. The active site has particular rigid shape into which the specific substrate fits exactly. The substrate is imagined being like a key whose shape is complementary to the enzyme or lock. Once formed, the product no longer fits into the active site and escapes into the surrounding medium. The active site is free to combine again with another substrate molecule.

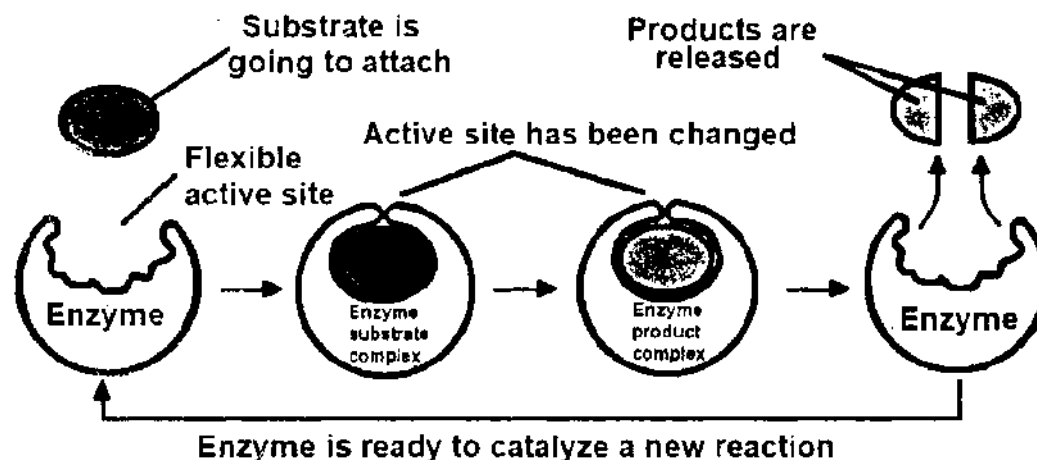


Fischer's "Lock and Key" hypothesis of enzyme action

Induced fit model:

Daniel Koshland proposed induced fit model. This model is more acceptable than the lock and key model. It describes that the binding of a substrate to enzyme causes a change in the shape of its active site. Active site is not a rigid structure rather it is flexible.

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Koshland's "Induced fit model" hypothesis of enzyme action

THE TERMS TO KNOW

1. **Activation energy:** The energy required to break chemical bonds and begin the reaction.
2. **Active site:** The small portion of enzyme molecule (around 34 amino acids) that is directly involved in catalysis.
3. **Amylase:** The enzyme that digests starch into disaccharides.
4. **Anabolism:** The chemical reactions in living organisms involved in the synthesis of compounds.
5. **Biocatalyst:** The catalyst in metabolic reactions i.e. the enzyme.
6. **Catabolism:** The chemical reactions in living organisms that breakdown larger molecule.
7. **Catalyst:** A compound / element which accelerates a chemical reaction without any change in itself.
8. **Coenzyme:** The organic cofactors of enzymes that are loosely attached with enzyme; transport chemical groups from one enzyme to another.
9. **Cofactor:** The non-protein molecules or ions required by enzymes for activity e.g., metal ions and organic molecules.
10. **Denaturation:** Damage or loss of structure of a molecule.
11. **Induced fit model:** Daniel Koshland proposed induced fit model. This model is more acceptable than the lock and key model. It describes that the binding of a substrate to enzyme causes a change in the shape of its active site. Active site is not a rigid structure rather it is flexible.
12. **Optimum pH:** The pH at which an enzyme works at its maximum rate.
13. **Optimum temperature:** The temperature at which an enzyme works at its maximum rate.
14. **Enzyme:** The proteins that catalyze (i.e. speed up) biochemical reactions but are not, changed during the reactions.

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15. **Lipase:** The enzyme that digests the lipids into glycerol and fatty acids.
 16. **Lock-and-key theory:** The model to explain the mechanism, of enzyme action; both the enzyme and the substrate possess specific complementary geometric shapes that fit exactly into one another.
 17. **Metabolism:** Collective term for all the biochemical reactions that occur in living organisms in order to maintain life
 18. **Product:** The molecules that are formed as the result of enzymatic reaction.
 19. **Saturation:** The state at which all the active sites of the enzymes are occupied and any more substrate molecules do not find free active sites.
 20. **Substrate:** The molecules at the beginning of enzymatic reactions; reactants in enzymatic reactions.

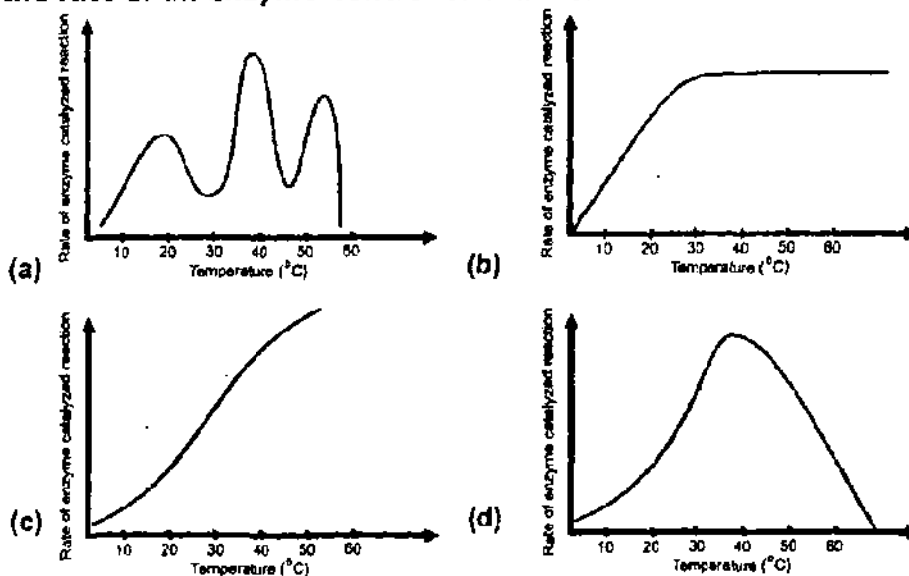
MULTIPLE CHOICE QUESTIONS

1. **What is TRUE about enzymes?**
 - A. They make biochemical reactions to proceed spontaneously
 - B. They lower the activation energy of a reaction
 - C. They are not very specific in their choice of substrates
 - D. They are needed in large quantities
2. **To what category of molecules do enzymes belong?**

A. Carbohydrates	B. Lipids
C. Nucleic acids	D. Proteins
3. **What is TRUE about cofactors?**
 - A. Break hydrogen bonds in proteins
 - B. Help facilitate enzyme activity
 - C. Increase activation energy
 - D. Are composed of proteins
4. **Prosthetic groups are;**
 - A. Required by all enzymes
 - B. Loosely attached with enzymes
 - C. Proteins in nature
 - D. Tightly bound to enzyme
5. **When we add more substrate to an already occurring enzymatic reaction and there is no increase in the rate of reaction, what would you predict?**
 - A. All active site have been occupied by substrate molecules
 - B. The enzyme molecules have denatured
 - C. More substrate acted as inhibitor
 - D. More substrate has disturbed the pH of the medium

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6. Which of these graphs correctly shows the effect of temperature on the rate of an enzyme-controlled reaction?



ANSWERS:

1. B	2. D	3. B	4. D	5. A	6. D
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MULTIPLE CHOICE QUESTIONS

- The energy required to break chemical bonds and begin the reaction
 - Biocatalyst
 - Co-factor
 - Anabolism
 - Activation energy
- The small portion of enzyme molecule (around 34 amino acids) that is directly involved in catalysis
 - Co-factor
 - Active site
 - Amylase
 - Inhibitor
- The chemical reactions in living organisms involved in the synthesis of compounds:
 - Co-factor
 - Catabolism
 - Anabolism
 - Amylase
- The catalyst in metabolic reactions i.e. the enzyme:
 - Inhibitor
 - Co-factor
 - Amylase
 - Biocatalyst
- The chemical reactions in living organisms that breakdown larger molecules
 - Catabolism
 - Amylase
 - Biocatalyst
 - Anabolism

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6. A compound / element which accelerates a chemical reaction without any change in itself:
 A. Co-factor B. Amylase C. Catalyst D. Inhibitor
 7. The organic cofactors of enzymes that are loosely attached with enzyme; transport chemical groups from one enzyme to another:
 A. Inhibitor B. Coenzyme C. Co-factor D. Amylase
 8. The non-protein molecules or ions required by enzymes for activity e.g., metal ions and organic molecules:
 A. Cofactor B. Amylase C. Inhibitor D. Enzymes
 9. Damage or loss of structure of a molecule:
 A. Substrate B. Saturation C. Denaturation D. Inhibitor
 10. The temperature at which an enzyme works at its maximum rate:
 A. Minimum Temperature B. Maximum Temperature
 C. Medium Temperature D. Optimum temperature
 11. The proteins that catalyze (i.e. speed up) biochemical reactions but are not, changed during the reactions:
 A. Enzyme B. Co-factor C. Amylase D. Inhibitor
 12. The molecules that stops enzymes working:
 A. Co-factor B. Amylase C. Inhibitor D. Substrate
 13. The enzyme that digests the lipids into glycerol and fatty acids:
 A. Lipase B. Amylase C. Biocatalyst D. Substrate
 14. Collective term for all the biochemical reactions that occur in living organisms in order to maintain life:
 A. Biocatalyst B. Anabolism C. Metabolism D. Biocatalyst
 15. The molecules that are formed as the result of enzymatic reaction:
 A. Product B. Reactant C. Substrate D. Saturation
 16. The state at which all the active sites of the enzymes are occupied and any more substrate molecules do not find free active sites:
 A. Co-factor B. Substrate C. Reactant D. Saturation
 17. The molecules at the beginning of enzymatic reactions; reactants in enzymatic reactions:
 A. Substrate B. Co-factor C. Saturation D. Reactant
 18. The enzyme that digests starch into disaccharides:
 A. Amylase B. Biocatalyst C. Inhibitor D. Anabolism

ANSWERS:

1. D	2. B	3. C	4. D	5. A
6. C	7. B	8. A	9. C	10. D
11. A	12. C	13. A	14. C	15. A
16. D	17. A	18. A		

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UNIT-07
BIOENERGETICS

CHAPTER WISE NOTES

Q1. What is bioenergetics? Describe its role in daily life.

Ans: Bioenergetics:

The study of energy relationships in biological system is called **bioenergetics**.

All metabolic reactions involve energy transformations. Biological energy transformations obey the laws of thermodynamics.

Significance of bioenergetics in daily life:

Because an organism can neither make nor destroy energy, it must have adaptations that allow it to capture energy from its environment, convert it to another form and use it for its own need. During photosynthesis the plant cells transform light energy to electrical energy and then to chemical energy stored in chemical bonds.

Some of that chemical energy may later be used to carry out the life functions of the plant cells, or it may be transformed by an animal that eats the plant to the mechanical energy of muscle or some other needed form. As these transformations take place, some of the energy is converted to heat and dissipated into the environment.

Q2. Briefly explain the importance of Redox Reactions?

Ans: Redox Reaction:

An oxidation-reduction (redox) reaction is a type of chemical reaction that involves a transfer of electrons between two species.

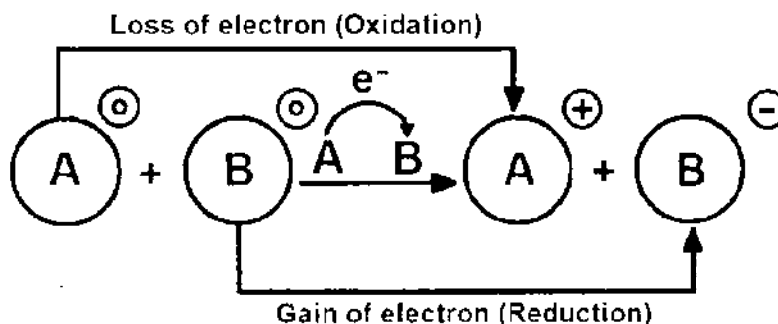
Redox is a type of chemical reaction in which the oxidation states of atoms are changed.

Importance of Redox Reactions:

Energy stored in chemical bonds can be transferred to new bonds, with electrons shifting from one energy level to another

Redox reactions play a key role in energy flow through biological system, because electrons that pass from one atom to another carry their potential energy. These electron transfers, which are equivalent to energy transfers, are an essential part of cellular respiration, and photosynthesis etc. Thus, **redox reactions** play an important role for the flow of energy through the living system.

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Redox reaction

Q3. Briefly explain why glucose is important to cell.

Ans: During cellular respiration glucose is broken down. Glucose is important to cell because it contains much chemical energy. Chemical bonds hold the atoms of the glucose molecule together. When these bonds are broken, energy becomes available.

The cell transfers the energy of glucose to the high-energy bonds of ATP.

Q4. How does process of photosynthesis take place in plants? Discuss its importance in plants.

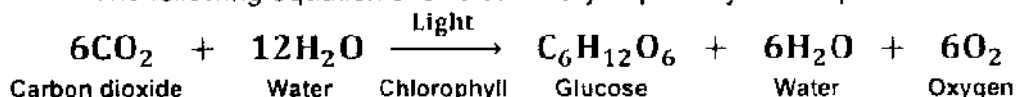
Ans: Photosynthesis is a process in which plants use carbon dioxide and water to make glucose in the presence of light which is absorbed by chlorophyll. Oxygen is produced as a by-product during photosynthesis.

Importance of photosynthesis:

It is an important biochemical process performed by plants, algae and cyanobacteria. Nearly all life form depends on photosynthesis for food directly or indirectly. It involves a series of coordinated reactions.

Chemical equation:

The following equation shows summary of photosynthesis process.



Q5. What is role of Carbon dioxide and Water in Photosynthesis?

OR

State how the varying carbon dioxide and water affect the rate of photosynthesis?

Ans: Intake of Carbon dioxide by Plants:

Carbon dioxide is raw material of photosynthesis. It provides carbon and oxygen for the synthesis of glucose ($\text{C}_6\text{H}_{12}\text{O}_6$) molecule. Atmosphere contains 0.04 percent carbon dioxide.

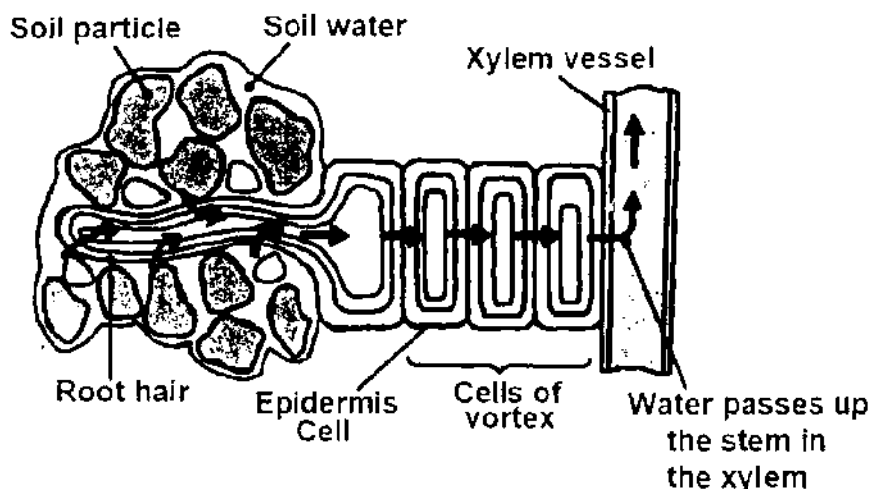
During photosynthesis carbon dioxide diffuses from the external environment through the stomata into the air spaces of the leaf. A thin layer of water always surrounds the surfaces of mesophyll cells.

Carbon dioxide is dissolved in this water and diffuses into mesophyll cells.

Intake of Water by Plants:

Water provides hydrogen which is used to reduce carbon dioxide to glucose. Water is present in soil. It is absorbed in root hair cells by osmosis process. It moves then to xylem of root and is transported up to the leaves.

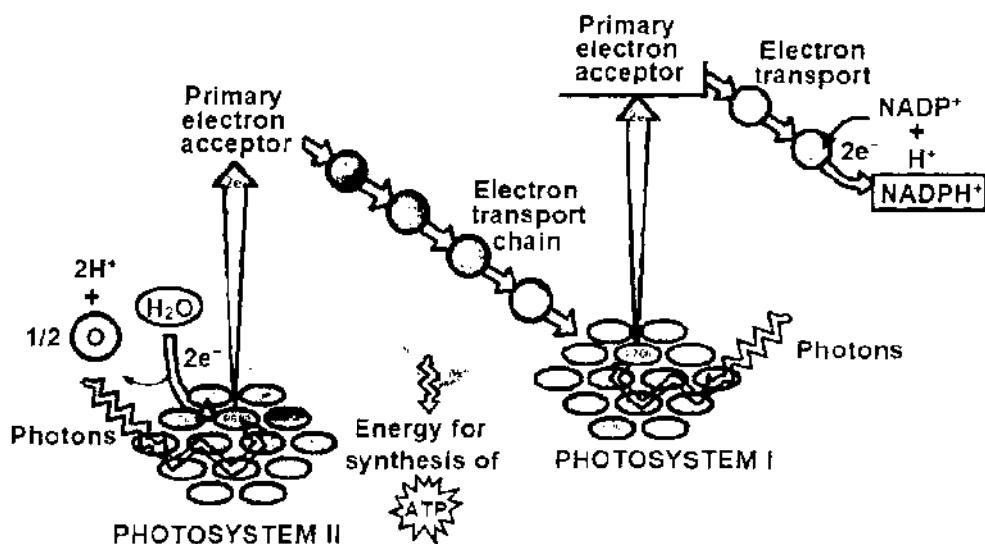
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Intake of water by plant

Q6. Outline the processes involved in photosynthesis?

Ans: Photosynthesis occurs in two phases. In the first phase, light energy is captured to produce ATP and NADPH. These reactions take place in thylakoid membranes of chloroplasts. These reactions occur only in the presence of light so are called light dependent reactions. During the second phase carbon dioxide is reduced by NADPH to form glucose molecule. This reduction requires energy which is provided by ATP. These reactions do not use light directly, they are known as light independent reactions.



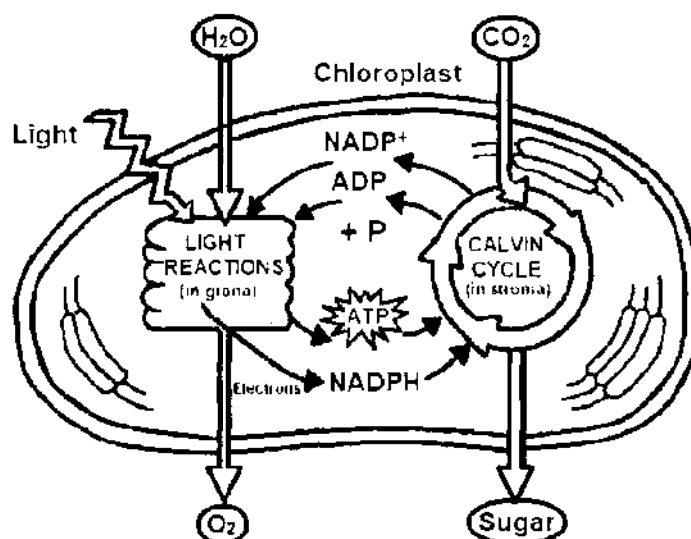
Light dependent reactions of photosynthesis

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Q7. Outline the products of light independent reactions of photosynthesis?

Ans: Light independent reactions of photosynthesis:

Requirements	The immediate products
ATP	ADP
NADPH	NADP
Carbon dioxide	3-carbon compound
5-carbon compound	Water
Enzymes in the chloroplasts	Inorganic phosphate



An overview of photosynthesis

Q8. Describe Respiration and enlist its types.

Ans: Respiration:

The process by which energy is produced from food is called respiration. Respiration is a chemical process, which takes place in cells. When we burn a fuel like petrol, energy is released in the form of light and heat. The same sort of things happens in our body. Our fuel is glucose from our food.

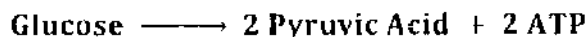
Types of Respiration:

The two main types of respiration are, anaerobic respiration and aerobic respiration.

Q9. How does glycolysis process take place in respiration?

Ans: Glycolysis:

The first phase of respiration is common both in anaerobic and aerobic respiration. This phase is called **glycolysis**. It takes place in cytoplasm. During glycolysis, glucose is oxidized into two molecules of pyruvic acid with the yield of two ATP molecules.



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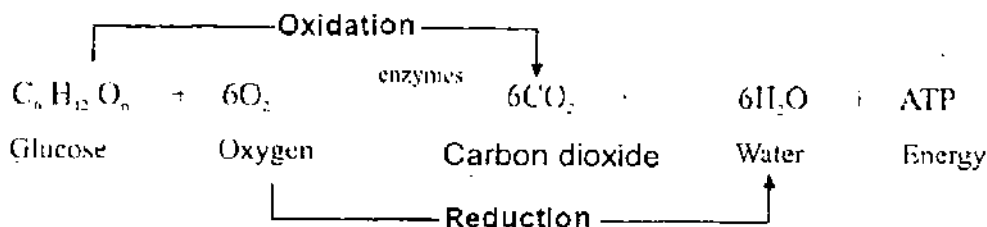
Q10. Outline the equation of mechanism of Aerobic Respiration?

Ans: Mechanism of Aerobic Respiration:

The word aerobic means presence of oxygen. Aerobic respiration, which requires oxygen, involves the complete breakdown of glucose to carbon dioxide and water.

Chemical equation of aerobic respiration:

Aerobic respiration can be summed up by the following equation.



Q11. Outline the mechanism of aerobic respiration while defining glycolysis, krebs cycle and electron transport chain.

Ans: Mechanism of Aerobic Respiration:

The process of respiration involves complex series of reactions.

Aerobic respiration is a continuous process, but for convenience we can divide it into three main stages;

- i. Glycolysis
- ii. Krebs cycle
- iii. Electron transport chain.

i. Glycolysis:

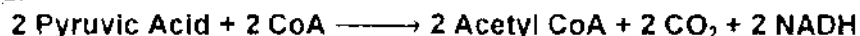
Glycolysis takes place in cytoplasm outside the mitochondria. It occurs both in anaerobic and aerobic respiration. Glucose is broken down into two molecules of pyruvic acid. Two ATP molecules are produced as net energy gain. Two NAD^+ molecules are reduced to NADH.



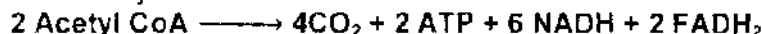
In glycolysis, glucose (6C) molecule is broken into two molecules of pyruvic acid (3C).

ii. Krebs cycle:

Each pyruvic acid molecule now enters a mitochondrion. Before the start of Krebs cycle pyruvic acid is oxidized to a two-carbon acetyl group which combines coenzyme A to form acetyl CoA. Carbon dioxide is removed and NADH is produced.



Krebs cycle is a cyclic process which takes place in mitochondrial matrix. Coenzyme A is released and acetyl group is passed through a series of reactions. The products of this process are CO_2 , NADH and FADH_2 . Some energy is released to produce ATP directly.



The main function of the Krebs cycle is to produce energy, stored and transported as ATP.

iii. Electron Transport Chain (ETC):

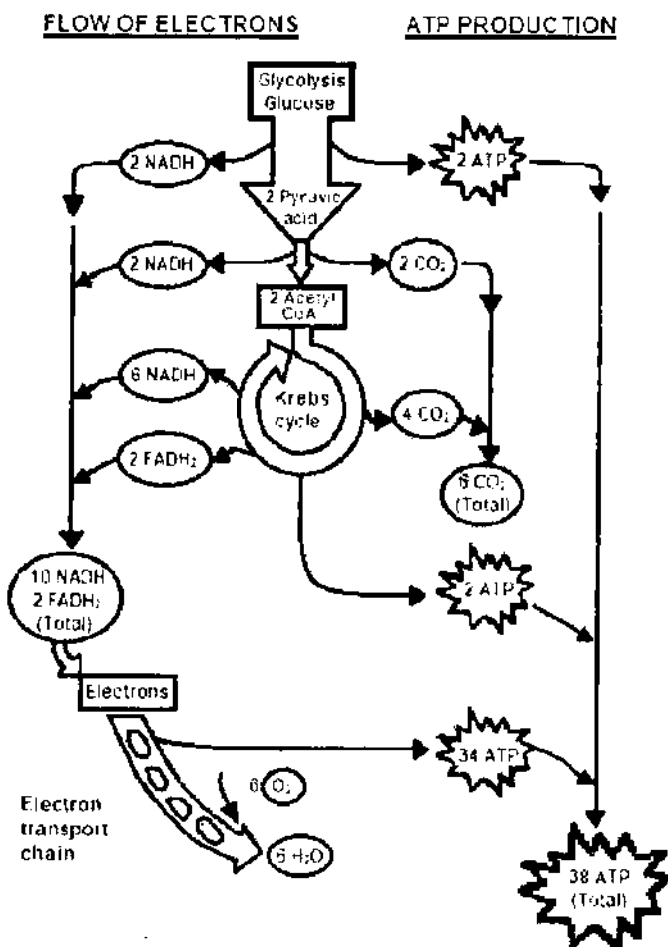
Electron transport chain is a series of electron carriers located in the inner membrane of mitochondria. The electrons that are removed by oxidation of food molecules during glycolysis and Krebs cycle are carried to ETC by NADH and

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FADH₂ When electrons coming through NADH pass through ETC, they provide enough energy to synthesize three ATP molecules. Each FADH₂ gives two ATP. The final electron acceptor is oxygen atom which then combines with hydrogen ions to produce water.

Aerobic respiration produces 38 ATP molecules. 2 ATP are utilized so it gives 36 ATP as net energy profit.

An overview of aerobic respiration:



Q12. Briefly explain that all life forms are dependent on photosynthesis.

Ans: All Life Forms are Dependent on Photosynthesis:

Two main products of photosynthesis are glucose and oxygen. Glucose is used to make cellulose, starch, proteins, fats and other organic compounds. Glucose is stored in stem, roots, fruits, and seeds in the form of glucose or starch e.g., grapes, mangoes, apples, carrots, turnips etc. All the heterotrophs directly or indirectly depend on food prepared by autotrophs by the process of photosynthesis. All aerobic organisms for respiration use oxygen gas released as a by-product during photosynthesis. Thus, all life forms are completely dependent on photosynthesis.

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SUMMARY

1. In plants photosynthesis occurs in chloroplast.
2. During photosynthesis, light energy is captured by chlorophyll and converted to chemical energy in a way that ultimately results in carbohydrate synthesis.
3. During the light dependent reaction of photosynthesis, chlorophyll electrons become excited. These electrons reduce NADP, forming NADPH and some of their energy is used to phosphorylate ADP, forming ATP.
4. During dark reactions, energy of ATP and NADPH is used to chemically combine carbon dioxide with hydrogen.
5. Cell uses two different types of catabolic pathways to extract free energy from nutrients: aerobic respiration and anaerobic respiration.
6. Aerobic respiration is a redox process in which electrons are transferred from glucose (which becomes oxidized) to oxygen (which becomes reduced).
7. The chemical reactions of aerobic respiration occur in four stages: glycolysis, formation of acetyl CoA, the Krebs cycle and the electron transport chain.
8. During glycolysis, which occurs in cytoplasm, a molecule of glucose is degraded to form two molecules of pyruvate.
9. Pyruvate is converted into acetyl CoA, which enters the Krebs cycle.
10. Water is formed when oxygen combines with Hydrogen and with electrons from the electron transport chain.

EXERCISE

(MCQs)

- **Select the correct answer:**
1. **Glycolysis is the breakdown of**
A. fructose
B. glucose
C. lactose
D. maltose
 2. **The mechanism of ATP synthesis is**
A. phosphorylation
B. photosynthesis
C. respiration
D. glucose
 3. **Pyruvate is the end product of**
A. Krebs cycle
B. plasmolysis
C. photolysis
D. glycolysis
 4. **In aerobic respiration pyruvic acid changes to**
A. glucose
B. fructose
C. Acetyl CoA
D. citric acid

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5. Which of these uses oxygen as the final acceptor?
 A. glycolysis B. electron transport chain
 C. Krebs cycle D. photosynthesis
6. Which of these produces carbon dioxide?
 A. Krebs cycle B. electron transport chain
 C. glycolysis D. photosynthesis
7. What are the products of light reactions in photosynthesis?
 A. ATP, NADPH and oxygen B. ATP and NADP
 C. ATP, PGA and oxygen D. PGA and oxygen
8. Which statement is false about the light dependent reactions?
 A. oxygen is liberated B. ATP is formed
 C. carbon dioxide is fixed D. water is split
9. The cells of green plants make starch from simple inorganic materials. What is the function of chlorophyll in this process?
 A. to absorb carbon dioxide B. to release oxygen
 C. to store starch D. to trap light energy
10. Which feature helps plants to make most food by the process of photosynthesis?
 A. broad and flat leaves B. shiny surfaced leaves
 C. spiky leaves D. variegated leaves

ANSWERS:

1. B	2. C	3. D	4. C	5. B
6. A	7. A	8. B	9. D	10. A

SHORT QUESTIONS

Q1. Name the constituents of ATP.

Ans: Constituents of ATP:

ATP is a nucleotide that consists of three main structures: the nitrogenous base, adenine; the sugar, ribose; and a chain of three phosphate groups bound to ribose. The phosphate tail of ATP is the actual power source which the cell taps

ATP is the energy currency of cell:

ATP – *Adenosine triphosphate* is called the energy currency of the cell. It is the organic compound composed of the phosphate groups, adenine, and the sugar ribose. These molecules provide energy for various biochemical processes in the body.

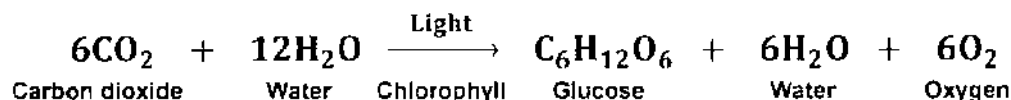
Q2. Write the equation of:

- a. photosynthesis
 b. fermentation c. aerobic respiration

Ans: (a) Equation of photosynthesis:

The following equation shows summary of photosynthesis process.

BIOLOGY NOTES FOR 9TH CLASS

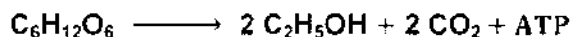
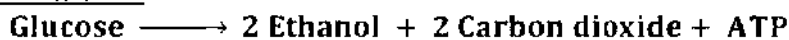


(b) **Equation of fermentation:**

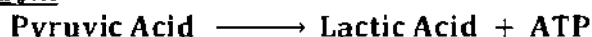
Alcoholic fermentation:



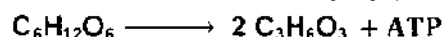
Ethanol Fermentation:



Lactic fermentation:

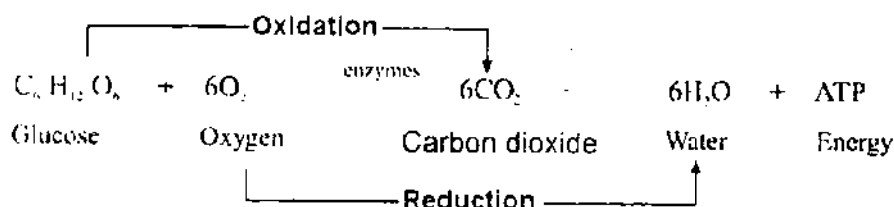


Lactic Acid Fermentation:



(c) **Equation of aerobic respiration:**

Aerobic respiration can be summed up by the following equation.



Q3. Name the products of anaerobic respiration in muscle cells.

Ans: Products of anaerobic respiration:

Following are the products of anaerobic respiration in muscle cells.

- i. Lactic acid ; (C₃H₆O₃)
- ii. ATP ; (Energy)

Q4. Why a part of photosynthesis is called dark reactions?

Ans: Dark Reactions/Light Independent Reactions:

Once the light reactions produce ATP and NADPH, a photosynthetic cell can fix carbon dioxide to build sugar molecules. The pathway now followed does not depend directly on light that is why it is called dark reactions or light independent reactions. It takes place in stroma of chloroplast.

OR

(Second Answer)

During second phase, carbon dioxide is reduced to make glucose. In this phase, the energy from high energy molecules (ATP and NADPH) is utilized. Since these reactions do not use light directly, they are known as dark reactions. The dark reactions take place in the stroma of the chloroplasts

Q5. In light reactions of photosynthesis why photosystem II occurs before the photosystem I?

Ans: Photosystems I and II are named such because Photosystem I was actually discovered (and named) before Photosystem II, even though Photosystem II comes before Photosystem I during photosynthesis (i.e., Photosystem II precedes Photosystem I in the electron flow of photophosphorylation).

BIOLOGY NOTES FOR 9TH CLASS

Q6. Differentiate between:

- a. oxidation and reduction
- b. ATP and ADP
- c. respiration and photosynthesis
- d. aerobic respiration and anaerobic respiration
- e. anaerobic respiration in yeast and muscle cell
- f. Light reaction and dark reaction of photosynthesis
- g. stroma and granum
- h. thylakoid and granum

Ans: a. Oxidation and Reduction:

Oxidation	Reduction
When an atom or molecule loses an electron, it is oxidized and the process is called <i>oxidation</i>	When an atom or molecule gains an electron, it is reduced, and the process is called <i>reduction</i> .
Increase in oxidation number	Decrease in oxidation number
All the oxidation reactions releases energy.	All the reduction reactions stores energy.
Oxidizing agents: Ozone, Bleach, peroxide	Common reducing agent is metal.

b. ATP and ADP:

ATP	ADP
ATP is a nucleotide which contains high energy in two phosphoanhydride known as the energy currency of life.	ADP is a nucleotide which is involved in transferring energy in cells. It mediates the energy flow within cells.
ATP is an abbreviation of Adenosine tri-phosphate	ADP is an abbreviation of Adenosine di-phosphate.
There are three phosphate groups in ATP	There are two phosphate groups in ADP.
It helps in active transport, building of molecules, cellular functions like muscle movement etc.	It helps in catabolism reactions, in the activation of platelets etc.
Chemical formula: $C_{10}H_{16}N_5O_{13}P_3$	Chemical formula: $C_{10}H_{15}N_5O_{10}P_2$

c. Respiration and Photosynthesis:

Properties	Respiration	Photosynthesis
Type of Metabolism	Catabolism	Anabolism
Occurs in	All living things	Only green parts of plants
When it occurs	All the time	Only in day light

BIOLOGY NOTES FOR 9TH CLASS

Organelle involved	Cytoplasm and Mitochondria	Chloroplast
Reactants	Glucose and Oxygen	CO ₂ and H ₂ O
Products	CO ₂ and H ₂ O	Glucose and Oxygen
Energy Conversion	Chemical energy is released in the form of Kinetic energy	Light energy is trapped in the form of chemical energy
Phases	Three Phases <ol style="list-style-type: none"> 1. Glycolysis 2. Kreb's Cycle 3. Electron Transport chain 	Two Phases <ol style="list-style-type: none"> 1. Light dependent reactions 2. Light independent reactions

d. **Aerobic respiration and Anaerobic respiration:**

Properties	Anaerobic Respiration	Aerobic Respiration
Reactants	Glucose	Glucose and Oxygen
Products	<ul style="list-style-type: none"> • Ethyl alcohol in Alcoholic Fermentation • Lactic acid in Lactic Acid Fermentation 	CO ₂ and H ₂ O
Oxidation	Incomplete	Complete
Location	In Cytoplasm	In Cytoplasm and Mitochondria
Stages	<ol style="list-style-type: none"> 1. Glycolysis 2. Fermentation 	<ol style="list-style-type: none"> 1. Glycolysis 2. Kreb's Cycle 3. Electron Transport Chain
Oxygen requirement	No	Yes
Energy yield	Low (2 ATP)	High (36-38 ATP)

e. **Anaerobic respiration in yeast and muscle cell:**

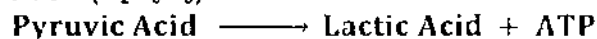
• **Anaerobic respiration in yeast:**

In alcoholic fermentation, pyruvic acid produced during glycolysis is converted into ethyl alcohol and carbon dioxide. It occurs in yeast and some bacteria.



• **Anaerobic respiration in muscle cells:**

Lactic acid fermentation occurs in skeletal muscles of humans and other animals during extreme physical activities. This also happens in the bacteria present in milk. In this type of anaerobic respiration, each pyruvic acid molecule is converted into lactic acid (C₂H₆O₃).



BIOLOGY NOTES FOR 9TH CLASS

f. Light reaction and dark reaction of photosynthesis:

Light reaction	Dark reaction
It takes place only in the presence of light.	It can take place in the presence or absence of sunlight.
It is a photochemical phase.	It is a biochemical phase.
It takes place in the grana of the chloroplast.	It takes place in the stroma of the chloroplast.
NADP utilizes H^+ ions to form NADPH.	The hydrogen of NADPH combines with CO_2 .
The end products are ATP and NADPH.	Glucose is the end product. ATP and NADPH help in the formation of glucose.
The water molecules split into hydrogen and oxygen.	Glucose is produced. CO_2 is utilized in the dark reaction.
Photolysis occurs in PS-II.	Photolysis does not occur.

g. Stroma and Granum:

Stroma	Granum
Stroma refers to a colorless jelly-like matrix of chloroplast in which the dark reaction of photosynthesis takes place.	Grana refers to the stacks of thylakoids embedded in the stroma of a chloroplast.
Jelly-like matrix of the chloroplast.	Disk-like plates in the stroma.
Consists of enzymes required for photosynthesis, cytochrome system, DNA and RNA of the chloroplast.	Consist of different pigments such as chlorophyll-a, chlorophyll-b, carotene, and xanthophyll.
The dark reaction of photosynthesis occurs here.	The light reaction of photosynthesis occurs here.
Embeds enzymes required by the dark reaction of photosynthesis	Provide a large surface for the attachment of photosynthetic pigments.

h. Thylakoid and Granum:

Thylakoid	Granum
Thylakoid is the pillow-shaped compartments in the chloroplast.	The grana refers to the stacks of thylakoids embedded in the stroma of a chloroplast.
Thylakoid is involved in the light reaction of photosynthesis by producing ATP and NADPH.	Grana organize thylakoids together and connect them together by stromal thylakoids in order to allow the functioning of thylakoids as a unit.
Thylakoids can be observed under the electron microscope.	Grana can be observed under the light microscope.

BIOLOGY NOTES FOR 9TH CLASS

Individual thylakoids have a lesser surface area for the process of photosynthesis in comparison to the stacked structure grana.

Grana increases the surface area for photosynthesis.

SHORT QUESTIONS

Q1. What are the immediate products of light reactions of photosynthesis?

Ans: Immediate products of light reactions of photosynthesis:

LIGHT REACTIONS OF PHOTOSYNTHESIS	
Requirements	The immediate products
Light	Oxygen
Enzymes in the chloroplasts	ATP
Water	NADPH
NADP ⁺	
ADP and inorganic phosphate	

OR

(Second Answer)

The main photosynthetic pigment **chlorophyll a** and accessory pigments **chlorophyll b**, **chlorophyll c** and carotenoids etc., trap the sunlight to carry out the light reactions of photosynthesis. The light reaction of photosynthesis produces ATP and NADPH which in turn serve as the energy source to drive the second phase of photosynthesis (dark reactions) during which carbohydrate synthesis takes place.

Q2. Name the three phases of aerobic respiration.

Ans: The complete process of aerobic respiration is divided into three main phases:

- Glycolysis
- Krebs Cycle
- Electron Transport Chain (ETC)

Q3. What is the main function of glycolysis, Krebs cycle and electron transport chain?

Ans: i. **Function of Glycolysis:**

Glycolysis is the first of the main metabolic pathways of cellular respiration to produce energy in the form of ATP. Through two distinct phases, the six-carbon ring of glucose is cleaved into two three-carbon sugars of pyruvate through a series of enzymatic reactions.

ii. **Function of Krebs cycle:**

The main function of the Krebs cycle is to transfer high energy electrons to the electron transport chain using the carriers used in Krebs cycle. The main function of the Krebs cycle is to produce energy, stored and transported as ATP.

BIOLOGY NOTES FOR 9TH CLASS

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iii. **Function of Electron Transport Chain (ETC):**

The electron transport chain is primarily used to send protons across the membrane into the intermembrane space.

The electron transport chain is a cluster of proteins that transfer electrons through a membrane within mitochondria to form a gradient of protons that drives the creation of adenosine triphosphate (ATP). ATP is used by the cell as the energy for metabolic processes for cellular functions

Q4. **Why are the majority of organisms so similar in their energy metabolism?**

Ans: Most widely and efficiently used carbon source is glucose starting from bacteria to human all use glucose as the primary source of energy.

That is why the majority of organisms are similar in their energy metabolism. All living organisms need energy to grow and reproduce, maintain their structures, and respond to their environments. Metabolism is the set of life-sustaining chemical processes that enables organisms transform the chemical energy stored in molecules into energy that can be used for cellular processes. Animals consume food to replenish energy; their metabolism breaks down the carbohydrates, lipids, proteins, and nucleic acids to provide chemical energy for these processes. Plants convert light energy from the sun into chemical energy stored in molecules during the process of photosynthesis. The free glucose released by the liver is for use by the brain and red blood cells.

Q5. **Only some plant cells have chloroplast but all living cells have mitochondria. Why?**

Ans: Chloroplast is found only in plant cells because it is used in the process of photosynthesis by plants. While Mitochondria is considered the "powerhouse of the cells". It is necessary because plants use ATP (adenosine triphosphate) and since mitochondria produces energy in the form of ATP, then plants and living cells must have mitochondria

Plant cells need both chloroplasts and mitochondria because they perform both photosynthesis and cell respiration. Chloroplast converts light (solar) energy into chemical energy during photosynthesis while mitochondria, the powerhouse of the cell produces ATP- the energy currency of the cell during respiration both for plants and all living cells.

EXTENSIVE QUESTIONS

Q1. **Describe the structure and uses of ATP.**

Ans: Structure of ATP:

ATP molecule is made up of three subunits

- i. A five-carbon sugar called ribose
- ii. A double ringed molecule called adenine
- iii. Three phosphate groups (PCM) linked in a chain called a triphosphate group.

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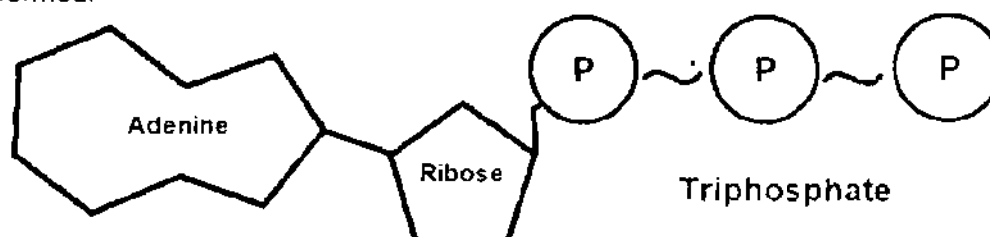
Adenosine:

Together, the ribose sugar and the adenine rings are called adenosine.

The "working end" of the ATP, however, is the triphosphate group. Attachment of one phosphate with adenosine form adenosine monophosphate (AMP).

Formation of adenosine triphosphate (ATP):

When a phosphate is added to AMP it becomes adenosine diphosphate (ADP). By adding one more phosphate group to ADP, adenosine triphosphate (ATP) is formed.



Structure of ATP (high energy bonds indicated by wavy lines)

High Energy Bonds:

The two covalent bonds linking the phosphate group together are shown by wavy lines. Such bonds were referred to as "high energy" or "energy-rich" bonds.

ATP — ADP Cycle:

ATP can be converted to ADP and inorganic phosphate by hydrolysis. This reaction releases 7.3 Kcal of energy. The third phosphate group splits from ATP, and this phosphate remains in the cell in inorganic form. ADP and phosphate can be converted back to ATP by condensation.

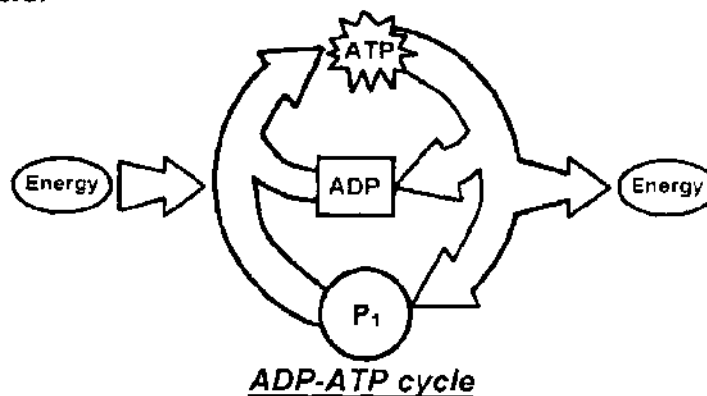
ATP as an energy currency of the cell:

ATP is often referred to as the energy currency of the cell because it is used much like money. When cells breakdown molecules in metabolic reactions, the energy that is released can be captured in molecules of ATP. The energy remains in the ATP until it is needed. ATP is made from oxidation of organic molecules during respiration. Most of the ATP in the cell is made in mitochondria.

Uses of ATP:

ATP can be used to make muscles contract, make nerve function, drive active transport and synthesis of proteins etc.

ADP-ATP cycle:



BIOLOGY NOTES FOR 9TH CLASS

Q2. Describe the light reactions of photosynthesis.

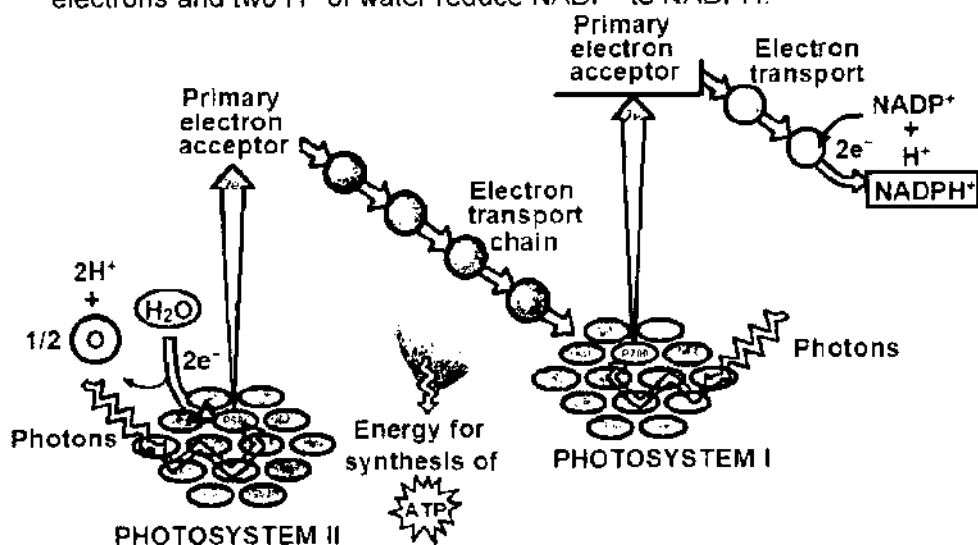
Ans: Light Dependent Reactions of Photosynthesis:

The reactions, which depend upon light, are called light dependent reactions of photosynthesis. These reactions take place in thylakoid membranes where photosynthetic pigments are arranged into clusters called photosystems. There are two types of photosystems:

Photosystem I and Photosystem II

Process of light dependent reactions starts from photosystem II.

- Chlorophyll a of photosystem II absorbs light and a pair of electrons is emitted from it.
- The emitted electron pair passes through electron transport chain and provides energy for ATP synthesis.
- At the same time photolysis takes place. In this process light splits water into oxygen atom, two hydrogen ions (H^+) and two electrons. Oxygen is released out while electron pair is provided to chlorophyll of photosystem II to compensate its electron loss.
- Light also acts on photosystem I which also gives out an electron pair. These electrons and two H^+ of water reduce $NADP^+$ to NADPH.



Light dependent reactions of photosynthesis

Q3. Describe the dark reactions of photosynthesis.

Ans: Dark reactions of photosynthesis:

Light independent reactions of photosynthesis:

Once the light reactions produce ATP and NADPH, a photosynthetic cell can fix carbon dioxide to build sugar molecules. The pathway now followed does not depend directly on light that is why it is called dark reactions or light independent reactions. It takes place in stroma of chloroplast.

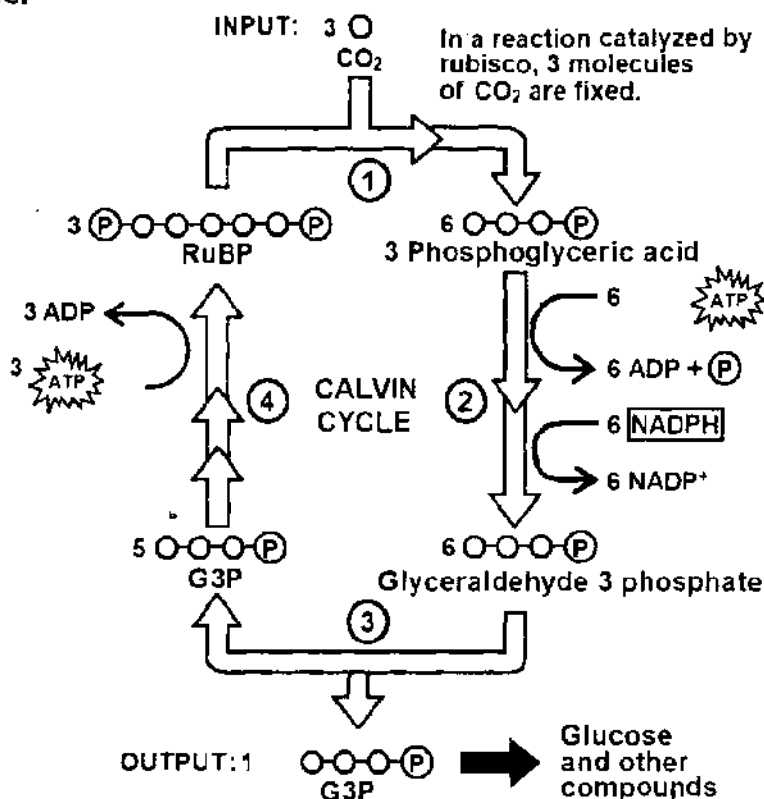
Calvin cycle:

The sequence of reactions in this phase was discovered by Melvin Calvin and his colleagues so are known as Calvin cycle.

BIOLOGY NOTES FOR 9TH CLASS

- i. Carbon dioxide combines with an already existing 5-carbon compound to form a 6-carbon intermediate.
- ii. This 6-carbon compound is unstable and splits into two 3-carbon compounds.
- iii. Now 3-carbon compounds are reduced to 3-carbon sugar by NADPH by using ATP energy.
- iv. The 3-carbon sugar molecules are used to synthesize glucose and also to regenerate original 5-carbon compound.

Calvin cycle:



Calvin cycle

Q4. Explain the factors affecting rate of photosynthesis.

Ans: Factors affecting rate of photosynthesis:

Limiting factors in photosynthesis:

Any environmental factor that tends to restrict the process of photosynthesis is called a limiting factor of photosynthesis.

The main external factors affecting the rate of photosynthesis are:

- (a) Light intensity
- (b) Carbon dioxide concentration
- (c) Temperature
- (a) **Light Intensity:**

An increase in light intensity speeds up photosynthesis, but only up to a point. Beyond this point, any further increase in light intensity has no effect. As all

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available chlorophyll molecules are fully occupied in light absorption. So, no matter how much the light intensity increases, no more light can be absorbed and used.

(b) Carbon dioxide Concentration:

Since there is only 0.04 percent of carbon dioxide in the air, it might seem that shortage of carbon dioxide could be an important limiting factor. An increase in carbon dioxide concentration does allow a faster rate of photosynthesis. However, carbon dioxide concentration after a certain limit causes the closure of stomata which decreases photosynthesis.

(c) Temperature:

The light independent reactions and to a certain extent, the light dependent reactions are enzyme controlled and therefore temperature sensitive. So, a suitable temperature is essential for photosynthesis to take place at normal rate. For most plants the optimum temperature is about 25°C. Temperature below or above the optimum will affect the rate of photosynthesis.

Q5. What are the adaptations in leaf structure for photosynthesis?

Ans: Adaptations in leaf structure for photosynthesis:

The leaf is a plant organ adapted to carry out photosynthesis. The table describes some of its adaptations:

Adaptation	Function
Thin leaves	Provides a short distance for carbon dioxide to move by diffusion into the leaf <u>Leaves are thin</u> , minimising the distance for carbon dioxide to travel into leaf cells. A midrib provides strength throughout the leaf, keeping it upright and sturdy in the wind. Chlorophyll is the green pigment that absorbs sunlight.
Contains chlorophyll	Absorbs light
Stomata	Allows carbon dioxide to move by diffusion into the leaf
Guard cells	To open and close the stomata depending on the conditions
Network of tubes (xylem and phloem)	To transport water (xylem) and food (phloem)

Intake of Carbon dioxide by stomata:

Carbon dioxide is raw material of photosynthesis. It provides carbon and oxygen for the synthesis of glucose ($C_6H_{12}O_6$) molecule.

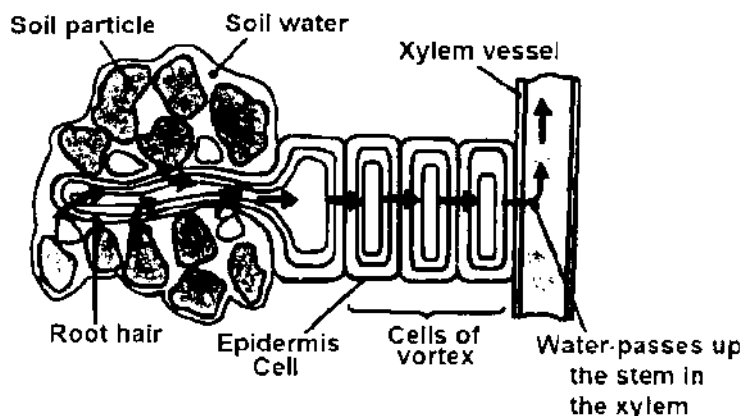
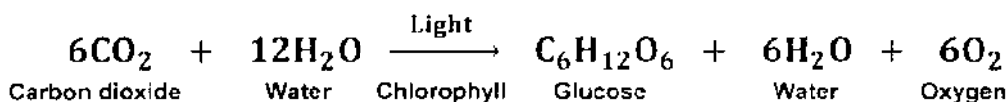
During photosynthesis carbon dioxide diffuses from the external environment through the **stomata** into the air spaces of the leaf.

A thin layer of water always surrounds the surfaces of mesophyll cells. Carbon dioxide is dissolved in this water and diffuses into mesophyll cells.

Intake of Water by Plants:

Water provides hydrogen which is used to reduce carbon dioxide to glucose. Water is present in soil. It is absorbed in **root hair cells** by osmosis process. It moves then to xylem of root and is transported up to the leaves.

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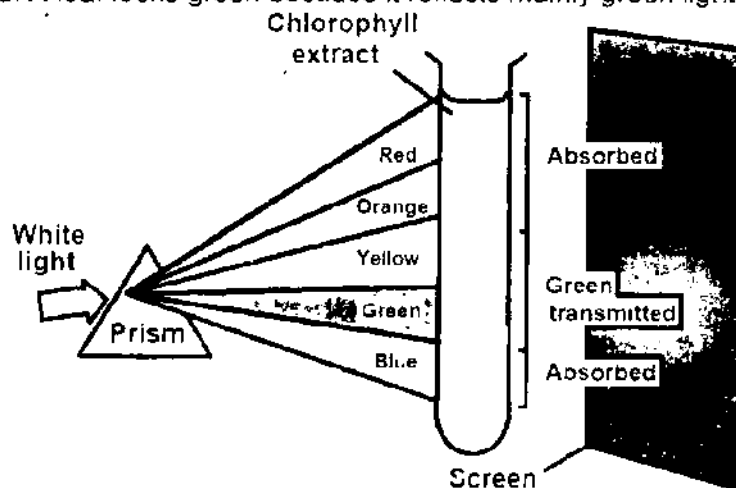


Role of light and chlorophyll in photosynthesis:

Light:

Photosynthesis utilizes only the portion of the electromagnetic spectrum, known as visible light which comes in discrete packets called photons. Light is the driving force for photosynthesis. Light absorbing molecules are called pigments.

In the membranes of thylakoids mainly blue, red and orange wavelengths are absorbed. A leaf looks green because it reflects mainly green light.



The light colours absorbed by Chlorophyll

Chlorophyll:

The chloroplast is the site of photosynthesis. The membranes of the thylakoids contain chlorophylls and other photosynthetic pigments.

Types of chlorophyll:

In green plants there are two types of chlorophyll i.e., chlorophyll a and chlorophyll b. Chlorophyll a is necessary for photosynthesis. It converts light energy to chemical energy. In thylakoid membranes photosynthetic pigments are arranged in clusters called photosystems.

BIOLOGY NOTES FOR 9TH CLASS

Q6. Write an experiment to show that plant needs light in order to make starch.

Ans: To prove the necessity of sunlight in photosynthesis following steps need to do:

- i. Take a plant with destarched leaf.
- ii. Leaf is partially covered with black paper on which a design is cut.
- iii. Expose this plant to sunlight for few hours and perform a starch test with iodine solution.

Observation:

- i. Covered leaf part shows brown colouration.
- ii. Exposed leaf shows blue-black colour.

Result: Starch is present in the exposed leaf.

Conclusion: Leaf exposed to sunlight give iodine test, proving that sunlight is necessary for photosynthesis.

Q7. Compare respiration and photosynthesis with examples.

Ans: Comparison of Respiration and Photosynthesis:

Properties	Respiration	Photosynthesis
Type of Metabolism	Catabolism	Anabolism
Occurs in	All living things	Only green parts of plants
When it occurs	All the time	Only in day light
Organelle involved	Cytoplasm and Mitochondria	Chloroplast
Reactants	Glucose and Oxygen	CO ₂ and H ₂ O
Products	CO ₂ and H ₂ O	Glucose and Oxygen
Energy Conversion	Chemical energy is released in the form of Kinetic energy	Light energy is trapped in the form of chemical energy
Phases	<u>Three Phases</u> <ol style="list-style-type: none"> 1. Glycolysis 2. Kreb's Cycle 3. Electron Transport chain 	<u>Two Phases</u> <ol style="list-style-type: none"> 1. Light dependent reactions 2. Light independent reactions
Examples	An example of respiration is inhaling and exhaling air. The action or process by which an organism without lungs, such as a fish or plant, exchanges gases with its environment. In air breathing vertebrates, respiration takes place in the lungs.	An example of photosynthesis is how plants convert sugar and energy from water, air and sunlight into energy to grow. The water from the leaves evaporates through the stomata, and filling its place, entering the stomata from the air, is carbon dioxide

BIOLOGY NOTES FOR 9TH CLASS

Q8. What are the advantages and significance of anaerobic respiration and fermentation in your daily life?

Ans: Advantages / Importance of Anaerobic Respiration:

Anaerobic respiration is important in following:

- i. The very first organisms had to produce energy by anaerobic respiration because the early earth did not have an oxygen atmosphere.
- ii. Anaerobic respiration by bacteria is used in cheese and yogurt making.
- iii. Fermentation by yeast is used in wine making and baking.
- iv. Anaerobic respiration provides energy to muscle cells during vigorous running or exercise by using lactic acid fermentation.

Significance of Anaerobic Respiration:

Anaerobic respiration is economically important - many of our foods are produced by microorganisms respiring anaerobically. Yeast is used to make alcoholic drinks. When yeast cells are reproducing rapidly during beer or wine production, the oxygen is used up.

Anaerobic respiration is less energy-efficient, but allows survival in habitats which lack oxygen.

THE TERMS TO KNOW

1. **Acetyl CoA:** A compound formed by the combination of acetate with the coenzyme A; acetate is formed from pyruvic acid.
2. **Adenine:** A double-ringed nitrogenous base; found in nucleic acids, ATP, NAD etc.
3. **ADP:** Adenosine Diphosphate; Formed of an Adenine, a Ribose and two phosphate groups.
4. **Aerobic Respiration:** The complete oxidation of glucose in the presence of oxygen.
5. **Alcoholic Fermentation:** The anaerobic respiration in which the pyruvic acid is further broken into carbon dioxide and ethyl alcohol.
6. **AMP:** Adenosine Monophosphate; Formed of an Adenine, a Ribose and one phosphate group.
7. **Anabolism:** The type of metabolism in which smaller molecules are joined to form larger and complex molecules.
8. **Anaerobic Respiration:** The incomplete oxidation of glucose in the absence of oxygen.
9. **ATP:** Adenosine Triphosphate; The energy currency for cells; Formed of Adenine, Ribose and phosphate groups.
10. **Autotrophic:** Organism able to synthesis its own food requirements to simple from simple organic material.
11. **Bioenergetics:** The study of energy relationships and energy transformations (conversions) in living organisms.
12. **Calvin Cycle:** The Dark Reaction; The cyclic reactions in which carbon dioxide is fixed to form carbohydrates, using the energy of ATP and Hydrogen of NADPH.

BIOLOGY NOTES FOR 9TH CLASS

- =====
13. **Chlorophyll:** The green pigments found in the chloroplasts of photosynthetic eukaryotes and in the cytoplasm of photosynthetic prokaryotes.
 14. **Coenzyme-A:** is a coenzyme that plays its role in the synthesis and oxidation of fatty acids.
 15. **Electron Transport Chain:** A series in which electrons are taken up by electron carriers and they lose energy, which is used to synthesize ATP molecules.
 16. **FAD:** Flavin Adenine Dinucleotide; A coenzyme in the Krebs cycle.
 17. **Glycolysis:** A step in aerobic and anaerobic respiration in which glucose molecule is broken to yield two molecules of pyruvic acid.
 18. **Krebs Cycle:** The cyclic reactions in aerobic respiration in which the pyruvic acid is further oxidized.
 19. **Lactic acid Fermentation:** The anaerobic respiration in which the pyruvic acid is reduced into lactic acid.
 20. **Light-dependent Reactions:**
The light-dependent reactions use light energy to make two molecules needed for the next stage of photosynthesis: the energy storage molecule ATP and the reduced electron carrier NADPH.
 21. **Limiting Factor:** The environmental factor the absence or deficiency of which can decrease the rate of a metabolic reaction.
 22. **Mesophyll:** The leaf tissue specialized for photosynthesis.
 23. **Metabolism:** The sum of all biochemical reactions that occur in living organisms.
 24. **NAD:** Nicotine-amide Adenine .
 25. **Oxidation:** The loss of electrons.
 26. **Photolysis:** Breakdown of water in the presence of light.
 27. **Photosynthesis:** The synthesis of glucose from carbon dioxide and water in the presence of sunlight (and chlorophyll), with oxygen as a by-product.
 28. **Photosystem:** The cluster of photosynthetic pigments, in the thylakoid membranes of chloroplasts.
 29. **Pigments:** The substance used as colouring. The primary function of pigments in plants is photosynthesis. Chlorophyll is the primary pigment in plants.
 30. **Pyruvic acid ($\text{CH}_3\text{COCO}_2\text{H}$):** It is an organic acid, a ketone, as well as the simplest of the alpha-keto acid. It supplies energy to living cells through the Krebs cycles.
 31. **Reduction:** The gain of electrons,
 32. **Respiration:** Cellular respiration; The process in which the C-H bonds of food are broken by oxidation-reduction reactions, releasing energy, carbon dioxide and water,
 33. **Stroma:** The part of chloroplast: site of the reactions of Calvin cycle,
 34. **Thylakoid:** The infoldings formed by the inner membrane of the chloroplast; site of the light reactions of photosynthesis,
 35. **Z-scheme:** The whole series of light reactions is called Z-scheme due to its Z-shaped flow chart.

BIOLOGY NOTES FOR 9TH CLASS

MULTIPLE CHOICE QUESTIONS

- In which of the following steps of respiration CO_2 is produced?**
A. Glycolysis
B. Krebs cycle
C. Electron transport chain
D. All of these
- Oxygen takes part in aerobic respiration in;**
A. Glycolysis
B. Link step between glycolysis and Krebs cycle
C. Krebs cycle
D. Electron transport chain
- When a plant was kept in darkness for many days its leaves turned yellow. Why?**
A. Leaves could not get oxygen and so there was no photosynthesis
B. Leaves could not get light and so there was no respiration
C. Leaves could not get oxygen and so there was no respiration
D. Leaves could not get light and so there was no photosynthesis
- From which bonds of ATP molecule energy is taken?**
A. P-P bonds
B. C-H bonds
C. C-N bonds
D. C-O bonds
- In which component of the leaf cells, chlorophyll is present?**
A. Stroma
B. Thylakoids
C. Plasma membrane
D. Cytoplasm
- Which of these can enter into Krebs cycle?**
A. Glucose
B. Pyruvic acid
C. Citric acid
D. Acetyl Co-A
- When we work hard we suffer from muscle fatigue because muscle cells;**
A. Carry out aerobic respiration at faster rate and so are tired
B. Carry out anaerobic respiration and so accumulate more CO_2
C. Carry out anaerobic respiration and so accumulate lactic acid
D. Carry out aerobic respiration and so accumulate lactic acid
- How many molecules of CO_2 are produced when Krebs cycle operates once?**
A. 01
B. 02
C. 03
D. 06
- In which of the following metabolic processes, oxidation as well as reduction of molecules occur?**
A. Photosynthesis
B. Respiration
C. Both
D. None of these
- Chlorophyll pigment absorbs maximum light in wavelengths of;**
A. Green and blue
B. Green and red
C. Green only
D. Red and blue

BIOLOGY NOTES FOR 9TH CLASS

ANSWERS:

1. B	2. D	3. D	4. A	5. B
6. D	7. C	8. B	9. C	10. D

MULTIPLE CHOICE QUESTIONS

- The infoldings formed by the inner membrane of the chloroplast; site of the light reactions of photosynthesis:**
A. Glycolysis
B. stroma
C. starch
D. Thylakoid
- The flow chart showing the light reactions of photosynthesis:**
A. Z-scheme
B. Light Reaction
C. Photolysis
D. Photosystem
- The anaerobic respiration in which the pyruvic acid is further broken into carbon dioxide and ethyl alcohol**
A. Anabolism
B. Catabolism
C. Starch
D. Alcoholic Fermentation
- Adenosine Monophosphate; Formed of an Adenine, a Ribose and one phosphate group**
A. AMP
B. ADP
C. ATP
D. FAB
- The type of metabolism in which smaller molecules are joined to form larger and complex molecules:**
A. Catabolism
B. Glycolysis
C. Anabolism
D. Starch
- The incomplete oxidation of glucose in the absence of oxygen:**
A. Aerobic Respiration
B. Glycolysis
C. Anaerobic Respiration
D. Fermentation
- Adenosine Triphosphate; The energy currency for cells; Formed of Adenine, Ribose and phosphate groups:**
A. AMP
B. ATP
C. ADP
D. FAB
- The study of energy relationships and energy transformations (conversions) in living organisms:**
A. Bioenergetics
B. Light Reaction
C. Dark Reaction
D. Photolysis
- The Dark Reaction; The cyclic reactions in which carbon dioxide is fixed to form carbohydrates, using the energy of ATP and Hydrogen of NADP:**
A. Krebs cycle
B. Glycolysis
C. Electron Transport Chain
D. Calvin Cycle

BIOLOGY NOTES FOR 9TH CLASS

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10. The green pigments found in the chloroplasts of photosynthetic eukaryotes and in the cytoplasm of photosynthetic prokaryotes:
- | | |
|----------------|-----------|
| A. Mesophyll | B. starch |
| C. Chlorophyll | D. stroma |
11. A series in which electrons are taken up by electron carriers and they lose energy, which is used to synthesize ATP molecules:
- | | |
|-----------------------------|-------------------|
| A. Electron Transport Chain | B. Light Reaction |
| C. Dark reaction | D. Calvin Cycle |
12. Flavin Adenine Dinucleotide; A coenzyme in the Krebs cycle:
- | | |
|--------|--------|
| A. AMP | B. ADP |
| C. FAD | D. ATP |
13. A step in aerobic and anaerobic respiration in which glucose molecule is broken to yield two molecules of pyruvic acid:
- | | |
|----------------|---------------|
| A. starch | B. Glycolysis |
| C. Chlorophyll | D. stroma |
14. The cyclic reactions in aerobic respiration in which the pyruvic acid is further oxidized:
- | | |
|-----------------|-----------------------------|
| A. Calvin Cycle | B. Glycolysis |
| C. Krebs Cycle | D. Electron Transport Chain |
15. The anaerobic respiration in which the pyruvic acid is reduced into lactic acid:
- | | |
|---------------|-----------------------------|
| A. Glycolysis | B. starch |
| C. Thylakoid | D. Lactic acid Fermentation |
16. The reactions of the first phase of photosynthesis in which light energy is captured and is used to make high energy molecules of ATP and NADPH:
- | | |
|--------------------|------------------|
| A. Light Reactions | B. Dark Reaction |
| C. Bioenergetics | D. Photolysis |
17. The environmental factor the absence or deficiency of which can decrease the rate of a metabolic reaction:
- | | |
|--------------------|------------------|
| A. Light Reaction | B. Dark Reaction |
| C. Limiting Factor | D. Photolysis |
18. The sum of all biochemical reactions that occur in living organisms:
- | | |
|---------------|---------------|
| A. Catabolism | B. Anabolism |
| C. Metabolism | D. Photolysis |
19. A coenzyme used in oxidation-reduction reactions:
- | | |
|-----------------|--------------|
| A. Dinucleotide | B. Thylakoid |
| C. Glycolysis | D. starch |
20. Breakdown of water in the presence of light:
- | | |
|------------------|-------------------|
| A. Dark Reaction | B. Light Reaction |
| C. Photolysis | D. starch |
21. The synthesis of glucose from carbon dioxide and water in the presence of sunlight (and chlorophyll), with oxygen as a by-product:
- | | |
|-------------------|------------------|
| A. Light Reaction | B. Dark Reaction |
| C. Photosynthesis | D. Glycolysis |
- =====

BIOLOGY NOTES FOR 9TH CLASS

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22. The cluster of photosynthetic pigments, in the thylakoid membranes of chloroplasts:
A. Glycolysis B. Thylakoid
C. Photosystem D. Photolysis
23. Cellular respiration; The process in which the C-H bonds of food are broken by oxidation-reduction reactions, releasing energy, carbon dioxide and water:
A. Respiration B. Light Reaction
C. Dark Reaction D. Photosynthesis
24. The part of chloroplast; site of the reactions of Calvin cycle:
A. Chlorophyll B. starch
C. Stroma D. Mesophyll

ANSWERS:

1. D	2. A	3. D	4. A	5. C
6. C	7. B	8. A	9. D	10. C
11. A	12. C	13. B	14. C	15. D
16. A	17. C	18. C	19. A	20. C
21. C	22. C	23. A	24. C	

BIOLOGY NOTES FOR 9TH CLASS

UNIT-08

NUTRITION

CHAPTER WISE NOTES

Q1. What are nutrients?

Ans: Nutrients:

Components of food required for normal growth and metabolism are called nutrients.

Q2. State the source of nutrition in plants.

Ans: Plants require only inorganic nutrients so that the plants can make their own organic food. Carbon dioxide is the source of carbon and water is the source of hydrogen for a plant. Oxygen can come from atmospheric oxygen or water.

Q3. Differentiate between nutrition and nutrients in plants.

Ans: Plants obtain inorganic elements from soil. These are called mineral nutrients and the mode of nutrition of mineral nutrients is called mineral nutrition. The mineral nutrients are of two types based on quantity in which they are required by the plants. **a. Macronutrients b. Micronutrients**

Q4. What are the role and effects of the lack of nitrate and magnesium ions on plant growth?

Ans: Role of nitrogen and magnesium:

Following are role of nitrogen and magnesium:

Nitrogen:

Plants obtain their nitrogen requirements from soluble nitrates. Nitrogen is an important part of amino acids and nucleic acid.

Deficiency/ lack of nitrogen causes: extremely stunted growth with small leaves and yellowing of leaves

Magnesium:

Magnesium is a constituent element of chlorophyll, so it takes part in the formation of chlorophyll.

Deficiency/ lack of magnesium: causes poor growth, yellowing of leaves followed by necrosis.

Q5. What do you know about nutrition in man?

Ans: Nutrients are the substance in food as energy source and for making structures. Nutrition is the process of taking in and using of food. All animals are heterotrophs.

Q6. What are lipids? Describe its sources and function.

Ans: Lipids:

Lipids consist mainly of carbon, hydrogen and little oxygen. A neutral lipid consists of glycerol joined to one, two or three fatty acids. Fats and oils together are called lipids.

BIOLOGY NOTES FOR 9TH CLASS

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Fat comes from animals is saturated and solid at room temperature. Oil comes from plants is unsaturated and liquid at room temperature.

Sources of Lipids:

Dairy products such as milk, butter, cheese, eggs, meat and fish are the examples of animal fats.

Examples of vegetable oils are mustard seed, groundnut, coconut, linseed and dry fruits etc. One gram of fat gives 9 kcal of energy.

Metabolic functions of Lipids:

Lipids are used to form cell membranes and the sheath surrounding the neuron.

Q7. Define balanced diet. How would you relate it with age, gender and activity?

Ans: Balanced Diet:

A balanced diet may be defined as the one which contains all the essential nutrients in correct proportion for the normal growth and development of body.

Relation of Balance diet with age, gender and activity:

The composition of the balanced diet is affected by age, gender and activity.

a. Age:

During growth period of the body there is higher basal metabolic rate. That is why at the age of one or two year it is highest, which decreases in the adults slowly throughout life.

Children need extra calcium for growing bones, iron for their red blood cells, vitamin D to help calcify their bones and vitamin A for disease resistance.

b. Gender:

Women of the same age, height and weight have less metabolic rate than men. This is due to difference in body. As the men have more muscular tissue and smaller amount of fatty tissue than women, so men need more energy for their normal body function.

c. Body Activity:

People who use a lot of energy in their daily life such as athletes or people with energetic jobs, which involve a lot of moving around or carrying things need more energy. People who have sedentary jobs, such as office workers, will need less energy.

Q8. What do you know about Malnutrition.

Ans: Malnutrition:

There are many nutritional problems, which affect a large number of persons. It may be under nutrition, over intake of nutrients, mineral diseases deficiency, anaemia etc. All of these are collectively called malnutrition.

Q9. Write a note on protein energy metabolism.

Ans: Protein energy malnutrition (PEM):

Protein energy malnutrition (PEM) is a major health and nutritional problem in the under developing countries of the world.

Protein energy malnutrition (PEM) is caused by deficiency of both protein and calories in the diet.

Example of diseases caused by PEM is Kwashiorkor and Marasmus.

BIOLOGY NOTES FOR 9TH CLASS

Q10. What are the health risks/effects of the lack/deficiency of sodium, calcium, iron, magnesium, iodine, copper and zinc in our diet?

Ans: MINERAL DEFICIENCY DISEASES (MDD):

- Less sodium in diet causes loss of appetite, retard growth, and respiratory failure.
- Low level of calcium causes spontaneous discharge of nerve fibres resulting tetany.
- Iron deficiency causes anaemia.
- Low magnesium concentration causes irritability.
- Deficiency of iodine in human diet causes goitre.
- Deficiency of copper causes loss of body weight.
- Zinc deficiency causes retarded growth and skin wounds.

Q11. What type of health problems cause as a result of over intake of nutrients (OIN)?

Ans: Over-Intake of Nutrients (OIN):

Over-intake of nutrients (OIN) is a form of malnutrition in which more nutrients are taken than the amounts required for normal growth, development, and metabolism. Over-intake of nutrients cause a number of health problems.

Examples:

- Over intake of nutrients can cause many health problems.
- Excess of carbohydrates and fats in food causes obesity, which may lead to high blood pressure.
- High dose of vitamin A may cause loss of appetite, cracking and bleeding lips, loss of hair, liver enlargement and pain in bone and joints.
- Excess dose of vitamin D are toxic causing deposition of calcium in soft tissues, arteries and formation of kidney stones.

Q12. State the effects of malnutrition. Explain them in details.

Ans: Effects of malnutrition:

The effects of malnutrition are starvation, obesity, heart diseases and constipation.

Starvation:

Starvation occurs when a human or another animal does not receive energy in their diet. The body starts to use up its energy reserves stored as fat and glycogen. When these are used up the body starts to use proteins i.e., body muscle, causing muscle wasting.

Starvation causes permanent organ damage that leads to death.

Obesity:

Obesity means overweight. Obesity may lead to angina, heart failure, anaemia, arthritis, diabetes and hypertension. Obesity shortens life expectancy.

The best way to control obesity is to lose weight by balanced diet, exercise and cut down on carbohydrates, fats, oils, and fried food.

Constipation:

A lack of dietary fibre in the diet causes constipation. Constipation is a condition of the digestive system where a person experiences hard faeces that are difficult to eliminate.

BIOLOGY NOTES FOR 9TH CLASS

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Heart Diseases:

The main cause is abnormally high blood cholesterol level and high blood pressure. Cholesterol deposition in the walls of blood vessels, makes them narrower and it leads to many heart diseases.

Taking unsaturated oils in the diet can prevent heart disease.

Q13. Write briefly about Assimilation.

Ans: Assimilation:

The products of digestion are carried round the body by the blood. These are absorbed by the body cells. The body cells use glucose, amino acids and fats. This uptake and use of food is known as assimilation. All the cells use glucose during cellular respiration to produce ATP.

Q14. Can you describe the structure of Large Intestine in your body?

Ans: Structure of Large Intestine:

The large intestine is a tube leading from the small intestine to the anus. It is 1.5 meters in length. It is larger than the small intestine in diameter. It consists of caecum, colon and rectum.

Caecum is the first blind part of large intestine. The ileum enters it from side. It has a pouch like end and to its base appendix is attached which is 10 cm long.

From colon water, salts and some vitamins are absorbed into the blood. Rectum temporarily stores faeces.

Defecation:

The semi solid waste, the faeces or stool is passed into the rectum by peristalsis and is expelled at intervals through the anus. The removal of undigested matter from the body is called egestion or defecation.

SUMMARY

1. Nutrients are the chemical substances in food that are used as energy source.
2. Plants obtain mineral nutrients from soil. There are two types of nutrients in plants: macronutrients and micronutrients.
3. The two types of fertilizers are organic fertilizers and inorganic fertilizers. Chemical fertilizers cause environmental hazards.
4. For balance diet humans require carbohydrates, proteins, fats, vitamins, minerals, water and dietary fibre.
5. Vitamins are organic compounds required in small amounts for many biochemical processes.
6. Minerals are inorganic nutrients ingested as salts dissolved in food and water.
7. Digestion of carbohydrates begins in mouth. As food is swallowed it is propelled through the pharynx and oesophagus
8. A bolus of food is moved along through the digestive tract by peristaltic action.
9. In the stomach, food is mechanically digested by vigorous, churning.

BIOLOGY NOTES FOR 9TH CLASS

10. Proteins are enzymatically digested by the action of pepsin in the gastric juice.
11. Most enzymatic digestion takes place in the duodenum which receives secretions from the liver and pancreas and produces several digestive enzymes of its own.
12. The liver produces bile, which emulsifies fats.
13. The pancreas releases enzymes that digest protein, carbohydrates, fats etc.
14. Chains of glucose are digested to maltose by salivary and pancreatic amylases.
15. Maltase in the small intestine splits maltose into glucose.
16. Proteins are split by pepsin in the stomach and by enzymes in the pancreatic juice.
17. Most nutrients are absorbed through the thin walls of the intestine. The large intestine is responsible for the elimination of undigested wastes.
18. Diarrhoea, constipation, ulcer, are the disorders of the gut.

EXERCISE

(MCQs)

● **Select the correct answer:**

- 1. This element is found in all proteins but not in carbohydrates:**

A. carbon	B. oxygen
C. hydrogen	D. nitrogen
- 2. Which of the following vitamins is required for the formation of collagen?**

A. Vitamin A	B. Vitamin B
C. Vitamin C	D. Vitamin D
- 3. Emulsification of fat will not occur in the absence of:**

A. lipase	B. bile
C. pancreatic juice	D. gastric juice
- 4. Process of conversion of simple absorbed food into complex compounds that become part of body is called:**

A. Digestion	B. Assimilation
C. Ingestion	D. Absorption
- 5. Bile is formed in:**

A. liver	B. gall bladder
C. pancreas	D. duodenum
- 6. The correct pair for deficiency cause is:**

A. vitamins A---scurvy	
B. Vitamin C---night blindness	
C. vitamin D---rickets	D. Vitamin D---scurvy

BIOLOGY NOTES FOR 9TH CLASS

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7. The largest gland, in the human body is:
A. gall bladder B. liver
C. pancreas D. salivary gland
8. Glycogen is stored in:
A. gall bladder B. spleen
C. liver D. pancreas
9. Common passage for swallowing food and breathing is:
A. pharynx B. glottis
C. larynx D. mouth
10. Digestion of both starch and protein is carried out by:
A. gastric juice B. saliva
C. bile D. pancreatic juice
11. If the mucous lining covering the stomach breaks down and stomach tissues are damaged it is:
A. appendicitis B. peptic ulcer
C. constipation D. diarrhoea
12. When large intestine fails to absorb water from the undigested part of the food, it results in:
A. constipation B. diarrhoea
C. appendicitis D. vomiting
13. Part of the digestive system, which is not in contact with food, is:
A. small intestine B. liver
C. caecum D. stomach
14. The diet component which prevent constipation is:
A. fibre B. protein
C. minerals D. vitamin

ANSWERS:

1. D	2. C	3. B	4. B	5. A
6. C	7. B	8. C	9. A	10. D
11. B	12. A	13. B	14. A	

SHORT QUESTIONS

Q1. What is the importance of fertilizers?

Ans: Importance of Fertilizers:

Fertilizers are chemical substances supplied to the crops to increase their productivity. The role of fertilizers is to increase yield and ensure healthy produce by supplying the right balance of nutrients to the soil.

Types of Fertilizers:

There are two types of fertilizers:

- a. Organic fertilizers b. Inorganic fertilizers

BIOLOGY NOTES FOR 9TH CLASS

a. Organic Fertilizers:

Humus is an organic material formed by the decaying animals manure along with rotten leaves, fruits and vegetables. The humus when added to the soil enriches the soil with organic matter and minerals. The clay humus complexes are fundamental to almost every physical, chemical and biological process that occurs in the soil. They influence water and nutrients retention and aeration.

b. Inorganic Fertilizers:

Usually the inorganic nitrogen, phosphorus and potassium are added to the soil, which are mostly depleted by the growing crops continuously.

Nitrogen is usually added to the soil in the form of ammonium nitrate, ammonium sulphate and urea. Phosphorus is added in the form of super phosphate, rock phosphates.

Potassium is added in the form of potassium chloride and potassium sulphate.

Q2. What are the environmental hazards of chemical fertilizers?

Ans: Environmental hazards of chemical fertilizers:

Phosphate containing fertilizer runs off into lakes and rivers and results in an overgrowth of algae and rooted aquatic plants. The result is eutrophication i.e., over enrichment, which can lead to an algal bloom.

When algae die, decomposers use up all available oxygen during decomposition the result is a massive fish kill.

Emission of the greenhouse nitrous oxide is caused by nitrogen fertilizers.

Ammonia gas is emitted from inorganic fertilizers, which can also increase soil acidity.

Q3. Name the metabolic functions of carbohydrates.

Ans: Metabolic Functions of Carbohydrates:

The four primary functions of carbohydrates in the body are to provide energy, store energy, build macromolecules, and spare protein and fat for other uses. Glucose energy is stored as glycogen, with the majority of it in the muscle and liver. After digestion carbohydrates are converted to glucose. It is absorbed and carried to the liver from where it is distributed to different parts of the body.

OR

(Second Answer)

Carbohydrate metabolism is a fundamental biochemical process that ensures a constant supply of energy to living cells. The most important carbohydrate is glucose, which can be broken down via glycolysis, enter into the Krebs cycle and oxidative phosphorylation to generate ATP.

BIOLOGY NOTES FOR 9TH CLASS

Q4. Distinguish between:

- a. carbohydrates and proteins
- b. glucose and amino acid
- c. macromolecules and micromolecule
- d. saturated and unsaturated fatty acids
- e. organic and inorganic fertilizers
- f. cardiac and pyloric sphincter

Ans: (a) carbohydrates and proteins:

Carbohydrates	Proteins
Carbohydrates are made up of sugar. Carbohydrates consist of carbon, hydrogen and oxygen atoms. The main purpose of carbohydrates is to provide fuel to the body cells.	Proteins are organic compounds made up of interlinked chains of amino acids, which consist of carbon, hydrogen, oxygen, nitrogen, and sulfur.
The carbohydrates we take, are in the form of sugar and starches.	Many proteins act as enzymes and hormones.
The main sources of carbohydrates are sugar, maize, barley, sweet potato, flour, rice, potato, honey, fig, grapes, sweets, and fruits.	Animal proteins are milk protein, egg protein and meat protein. Vegetable proteins are pulses, legumes, nuts, fresh fruits and dry fruits

(b) glucose and amino acid:

Glucose	Amino acid
An aldohexose monosaccharide (chemical formula: $C_6H_{12}O_6$) Functions primarily as the main source of metabolic energy in living things.	Amino acids are organic compounds that contain amino ($-NH_2$) and carboxyl ($-COOH$) functional groups, along with a side chain (R group) specific to each amino acid. The key elements of an amino acid are carbon (C), hydrogen (H), oxygen (O), and nitrogen (N).
Glucose is one of the products of photosynthesis in plants and other photosynthetic organisms.	Amino acids are the building blocks of proteins and play an important role in body functions.
Glucose is also an important constituent of several other biological compounds, such as the structural carbohydrates, cellulose and chitin	Amino acids are commonly used as supplements in cell culture media and in metabolism research

BIOLOGY NOTES FOR 9TH CLASS

(c) macromolecules and micromolecule:

Macromolecules	Micromolecule
Molecule having high molecular weight is called macromolecule.	A molecule having low molecular weight is called micro molecule.
These are required by plants in larger quantities.	These are required by the plant in traces.
Macromolecules are defined as molecules being composed by about 1000 atoms. These might be either organic molecules (proteins, DNA, etc..) or natural/synthetic polymers.	"Micromolecules" is only used in biochemistry to indicate fatty acids, amino acids, proteins of low molecular weight.

(d) saturated and unsaturated fatty acids:

Saturated fatty acids	Unsaturated fatty acids
Saturated fatty acids are the simplest form of fats that are unbranched linear chains of CH_2 groups linked together by carbon-carbon single bonds with a terminal carboxylic acid.	Unsaturated fatty acids are more complex fatty acids with bent hydrocarbon chains linked together by carbon-carbon double bonds with a terminal carboxylic acid group.
Hydrogenation is not possible in saturated fatty acids as no more hydrogen atoms can be added to the hydrocarbon chain.	Hydrogenation is possible in unsaturated fatty acids as the double bonds can be converted to single bonds.
Saturated fatty acids exist in the solid-state at room temperature	Unsaturated fatty acids exist in the liquid state at room temperature.
Saturated fatty acids are mostly found in animal fats like butter, meat, and whole milk.	Unsaturated fatty acids are mostly found via plant sources like vegetable oil, sunflower oil, mustard oil, avocado oil, etc.

(e) organic and inorganic fertilizers:

Organic fertilizers	Inorganic fertilizers
Organic fertilizers are derived from plant and animal materials.	Naturally occurring inorganic fertilizers include rock phosphate, elemental sulfur and gypsum. These are not chemically modified.
They are more complex and take time to be broken down into forms usable by plants.	Usually the inorganic nitrogen, phosphorus and potassium are added to the soil, which are mostly depleted by the growing crops continuously.
They can also increase soil drainage, aeration and the ability of the soil to hold nutrients.	Most inorganic fertilizers dissolve readily in water and are immediately available to plants for uptake.

BIOLOGY NOTES FOR 9TH CLASS

(f) cardiac and pyloric sphincter:

Cardiac sphincter	Pyloric sphincter
Cardiac sphincter is between stomach and oesophagus	Pyloric sphincter is between stomach and small intestine
The cardiac portion is present immediately after oesophagus.	The pyloric portion is located beneath the cardiac portion.
Prevents the acidic contents of the stomach going upward into the oesophagus.	Controls the release of chyme from the stomach into the duodenum.

Q5. What do you think can be reasons or causes for famine?

Ans: Reasons and causes for Famine: Famine is the lack of enough food to feed all the people living in an area. The reasons of famine are unequal distribution of food, drought, flooding, increasing population etc.

a. Unequal Distribution of Food:

The world as a whole produces more than enough food to supply everyone on Earth. However, this food is unequally distributed. In some parts of the world, there is more than enough for everyone. In other parts of the world, the food produced is not enough for its population.

b. Drought:

The lack of rainfall is called drought, which stops crops from growing. Many areas are drought areas of world including Pakistan e.g., some areas in Balochistan and Sindh. As a result, population had to migrate as many animals and human beings died.

c. Flooding:

Due to flood the land becomes muddy and marshy, so it is not possible to grow the crops immediately. People who rely on locally grown crops for their food will then have little to eat. They will not be able to save seeds to plant next year.

d. Increased Population:

As human population continues to get larger, the problems of food shortage will become more and more intense. In parts of the world where soils are not fertile, or where water is in short supply, cause tremendous damage to the land. Eventually, the soil may become so dry and infertile that crops can no longer be grown and famine results.

Q6. Write the functions of: saliva, liver, gall bladder, pancreas, villus, bile, intestinal gland, gastric gland, pepsin, renin, goblet cells, HCl in stomach, amylase, lipase, trypsin, amino peptidase, enterokinase, erepsin, lactase, maltase, sucrase, lacteal, vitamin A, vitamin C, vitamin D, hepatic portal vein.

Ans:

Terms	Function
Saliva	Saliva has two main functions. First it adds water and mucous to the food which act as lubricant to ease the passage of food through oesophagus. Second, saliva contains an enzyme salivary amylase , which aids in the partial digestion of starch.

BIOLOGY NOTES FOR 9TH CLASS

Liver	i. The liver cells manufacture bile. ii. Excess of glucose is stored by the liver as glycogen iii. Liver converts glycerol and amino acids to glucose molecules. iv. Liver removes amino group from amino acids. It is called deamination. v. Ammonia is converted into urea in the liver. vi. Majority of the plasma proteins are synthesized in the liver. vii. Destroys old red blood cells. viii. Stores fat-soluble vitamins (A, D, E and K) and mineral ions such as iron.
Gall bladder	i. To store and concentrate bile. ii. To respond to intestinal hormones (such as cholecystokinin) to empty and refill its bile stores. iii. To contribute to regulating the composition of bile (the percentage of water, bile salts and more)
Pancreas	It plays an essential role in converting the food we eat into fuel for the body's cells. The pancreas has two main functions: an exocrine function that helps in digestion and an endocrine function that regulates blood sugar.
Villus	The villi increase the surface area of the inner walls and it helps a lot in the absorption of digested food.
Bile	Bile emulsifies fats causing them to break down into small droplets called emulsion. Emulsification provides relatively large surface areas of lipid for the action of lipase enzymes.
Intestinal Gland	Chyme stimulates the intestinal glands to secrete intestinal juice.
Gastric gland	These glands are responsible for the synthesis and secretion of the gastric juice.
Pepsin	Pepsin partially digests the protein portion of food (bulk of mutton) into polypeptides and shorter peptide chains.
Renin	Renrin is secreted only in infants. It helps in the digestion of milk protein. By the churning action of stomach wall, the food mixed into a soupy mixture called chyme. When the chyme reaches a certain degree of acidity the pylorus relaxes and a little food passes into the duodenum.
Goblet cells	Goblet cells are responsible for the production and maintenance of the protective mucus blanket by synthesizing and secreting high-molecular-weight glycoproteins known as mucins.

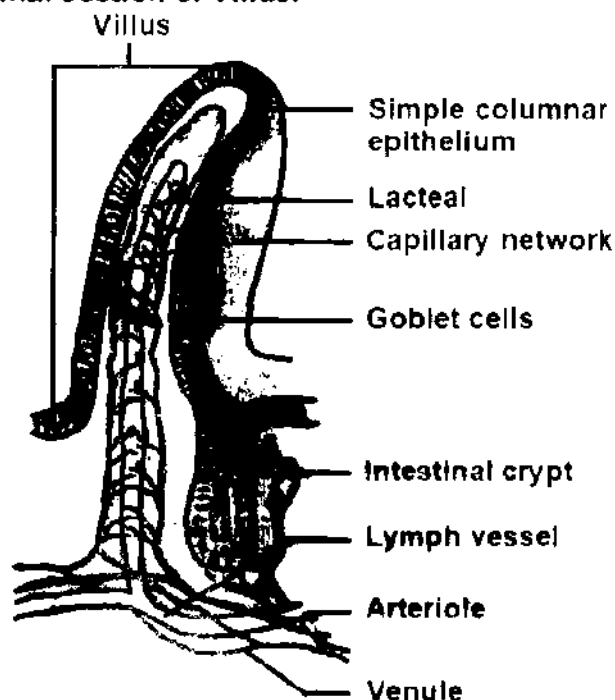
BIOLOGY NOTES FOR 9TH CLASS

HCl in stomach	Hydrochloric acid helps your body to break down, digest, and absorb nutrients such as protein.
Amylase	Pancreatic amylase is the starch-digesting enzyme. It converts polysaccharides to maltose and even to glucose.
Lipase	Lipase digest proteins, carbohydrates and lipids respectively.
Trypsin	Trypsin converts proteins into polypeptides.
Amino peptidase	Amino acids play important role to make new cells and tissues for growth or repair.
Enteropeptidase	It secretes enteropeptidase which activates pancreatic trypsinogen into its active form trypsin.
Erepsin	Erepsin converts peptides into amino acids.
Lactase	Lactase converts lactose to glucose.
Maltase	Maltase converts maltose to glucose etc.
Sucrase	Sucrase is responsible for catalyzing the hydrolysis of dietary carbohydrates that includes starch, sucrose, and isomaltase.
Lacteal	Lacteal is a lymphatic capillary that absorbs dietary fats in the villi of the small intestines.
Vitamin A	It is needed for synthesis of visual pigments rhodopsin of rod cells and iodopsin of cone cells for eyesight. It is responsible for maintenance of healthy skin, hair and mucous membrane and for proper bone growth.
Vitamin C	It is needed for forming collagen. Vitamin C helps to maintain capillaries, bones and teeth. It aids in absorption of iron and synthesis of hormones.
Vitamin D	Vitamin D regulates absorption of calcium and phosphorus by the intestine and their retention in the body and deposition in bones and teeth.
Hepatic portal vein	The hepatic portal vein is a vessel that moves blood from the spleen and gastrointestinal tract to the liver.

BIOLOGY NOTES FOR 9TH CLASS

Q7. Draw and label longitudinal section of villus.

Ans: Longitudinal section of Villus:



Longitudinal section of Villus

Q8. What do you understand by balanced diet? Give its significance.

Ans: **Balanced Diet:**

A diet containing the right amount of all nutrients is known as a balanced diet. A balanced diet must contain enough carbohydrates and fats to meet our energy needs.

Balanced diet must also contain enough protein of the right kind to provide the essential amino acids to make new cells and tissues for growth or repair. The diet must also contain vitamins and mineral salts, dietary fibre and water.

- **Starchy carbohydrates:**
Bread, rice, potatoes, pasta
- **Fruit and vegetables:**
Fresh, Frozen, Tinned, Dried
- **Protein:**
Eggs, Beans, Meat, Fish and Vegetarian options like Soya and Quorn
- **Dairy:**
Milk, Yoghurt, Cheese
- **Food and drink high in fat and/or sugar**

Significance of balanced diet:

A balanced diet supplies the nutrients your body needs to work effectively. Without balanced nutrition, your body is more prone to disease, infection, fatigue, and low performance.

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- i. Prevents diseases and infections.
- ii. Helps you control your weight.
- iii. Improves your mental health.
- iv. Good for growth.
- v. Better skin and hair.

Q9. How is digested fat absorbed?

Ans: In the stomach fat is separated from other food substances. In the small intestines bile emulsifies fats while enzymes digest them. The intestinal cells absorb the fats. Long-chain fatty acids form a large lipoprotein structure called a chylomicron that transports fats through the lymph system.

Q10. Why is digestion necessary?

Ans: Digestion:

The breakdown of large food molecules, into small soluble food molecules with the help of enzymes is called digestion.

Why it is necessary?

Digestion is important for breaking down food into nutrients, which the body uses for energy, growth, and cell repair. Food and drink must be changed into smaller molecules of nutrients before the blood absorbs them and carries them to cells throughout the body.

Q11. Give one example of water soluble and fat-soluble vitamins.

Ans: Water soluble vitamins:

The water-soluble vitamins include ascorbic acid (vitamin C), thiamin, riboflavin, niacin, vitamin B₆ (pyridoxine, pyridoxal, and pyridoxamine), folacin, vitamin B₁₂, biotin, and pantothenic acid

Fat - soluble vitamins:

Vitamins A, D, E, and K are called the fat-soluble vitamins, because they are soluble in organic solvents and are absorbed and transported in a manner similar to that of fats.

Q12. Name the structures that secrete enzymes necessary for human digestion?

Ans: The main enzyme-producing structures of the human digestive system are:

- i. Salivary glands
- ii. Stomach
- iii. Pancreas
- iv. Liver
- v. Small intestine

Q13. Why is pepsin formed in inactive form pepsinogen?

Ans: Pepsin enzyme is secreted by gastric glands of the stomach as inactive pepsinogen to protect the cells of these secretory glands from strong protein digesting action of the enzyme. The inactive form of the enzyme is activated by acidic pH of stomach lumen and the stomach wall is protected by mucus lining.

Pepsin is secreted as inactive pepsinogen. HCl or already present pepsin converts it to pepsin. Pepsin digests proteins to polypeptides (chain of many amino acids) and peptides (chain of few amino acids)

Q14. A man cannot digest cellulose but a cow can digest it. Why?

Ans: Humans are unable to digest cellulose because the appropriate enzymes to breakdown the beta acetal linkages are lacking. They do not have cellulose-digesting bacteria in their stomach. Undigestible cellulose is the fiber which aids in the smooth working of the intestinal tract.

BIOLOGY NOTES FOR 9TH CLASS

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Animals such as cows, horses, sheep, goats, and termites have ***symbiotic bacteria*** in the intestinal tract. This is the reason such animals can digest cellulose.

Q15. Why must digested food be distributed by blood in man and other animals?

Ans: Digestion is important for breaking down food into nutrients, which the body uses for energy, growth, and cell repair. Food and drink must be changed into smaller molecules of nutrients before the blood absorbs them and carries them to cells throughout the body. The body breaks down nutrients from food and drink into carbohydrates, protein, fats, and vitamins.

Q16. How is chewing important to your digestion?

Ans: Chewing your food sends messages to the gastrointestinal system that food is on its way. This triggers hydrochloric acid production helping food move through the digestive tract. Chewing food thoroughly also helps relax the stomach by releasing saliva and allows the food to be passed more easily into the intestines.

Q17. What would happen if pancreatic juice did not reach to your small intestine?

Ans: If Pancreatic juices may not reach the duodenum if the duct or papilla is blocked, or if the pancreas is so damaged by disease that it cannot produce adequate bicarbonate and enzymes.

Lack of pancreatic juices results in inadequate digestion. Excessive fat in the stools is called "steatorrhea". Because food is not absorbed properly patients usually lose weight.

Q18. Why you cannot breathe while you are swallowing?

Ans: When you swallow, a flap called the epiglottis moves to block the entrance of food particles into your larynx and lungs. To prevent food from going down the wrong pipe, nature has provided us with a 'flap' or a 'door' called epiglottis. Epiglottis stands atop the windpipe, guarding its opening. That is why we cannot breathe while we are swallowing.

Q19. What are the causes of:

(a) **Marasmus**

(b) **Kwashiorkor**

Ans: (a) Marasmus:

The wasting of the body resulting from general starvation is called marasmus. Patients lose all their body fat and muscle strength. They acquire a skeletal appearance.

(b) Kwashiorkor:

A growing child who does not get enough protein develops this disease. Growth is retarded and a child is weak.

EXTENSIVE QUESTIONS

Q1. Carbohydrates are major components of food for man. Explain.

Ans: Carbohydrates:

Carbohydrates are one of the major components of food for man.

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The term carbohydrate means "hydrate (water) of carbon" reflects the 2.1 ratio of hydrogen to oxygen, the same ratio found in water (H₂O).

Sources of Carbohydrates:

The main sources of carbohydrates are sugar, maize, barley, sweet potato, flour, rice, potato, honey, fig, grapes, sweets, and fruits. The carbohydrates we take, are in the form of sugar and starches. Except milk sugar all other sugars are obtained from the plants. One gram of carbohydrate on oxidation in the cells produce 4kcal of energy.

Metabolic Functions of Carbohydrates:

The four primary functions of carbohydrates in the body are to provide energy, store energy, build macromolecules, and spare protein and fat for other uses. Glucose energy is stored as glycogen, with the majority of it in the muscle and liver. After digestion carbohydrates are converted to glucose. It is absorbed and carried to the liver from where it is distributed to different parts of the body.

Q2. What are proteins? What are the metabolic functions of proteins?

Ans: Proteins:

The subunits of proteins are amino acids. The amino acids that animals cannot synthesize must be obtained from the diet are known as essential amino acids.

Sources of Proteins:

Animal proteins are milk protein, egg protein and meat protein. Vegetable proteins are pulses, legumes, nuts, fresh fruits and dry fruits. One gram of protein produces 4 kcal of energy.

Metabolic Functions of Proteins:

The metabolic functions of proteins are.

- Many proteins act as structural proteins and take part in building and repairing of the body tissue.
- Many proteins act as enzymes and hormones.
- The protein haemoglobin found in red blood cells transports oxygen.
- Actin and myosin are functional and structural proteins of the muscles and help in muscle contraction.

Q3. Write a note on fats.

Ans: Fats: Fat is a term used to describe a class of macro nutrients used in metabolism called triglycerides. These make up one of three classes of macronutrients including proteins and carbohydrates

Types of Fat: Fat is organized into three major types. saturated fat, unsaturated fat and trans fat.

i. Saturated fat:

Saturated fat is solid at room temperature, which is why it is also known as "solid fat". It is mostly in animal foods, such as milk, cheese, and meat. Poultry and fish have less saturated fat than red meat. Saturated fat is also in tropical oils, such as coconut oil, palm oil, and cocoa butter.

ii. Unsaturated fat:

Unsaturated fat is further classified as monounsaturated fat, polyunsaturated fat, and trans-fat. These different classifications determine the effects of these fats on an organism, and the roles that they have in metabolism. Unsaturated fat is liquid at room temperature. It is mostly in oils from plants.

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Monounsaturated fat and polyunsaturated fat are sub types of unsaturated fat.

(a) Monounsaturated fat:

This fat is in avocado, nuts, and vegetable oils, such as canola, olive, and peanut oils. Eating foods that are high in monounsaturated fats may help lower your "bad" LDL cholesterol. Monounsaturated fats may also keep "good" HDL cholesterol levels high. But eating more unsaturated fat without cutting back on saturated fat may not lower your cholesterol.

(b) Polyunsaturated fat:

This type of fat is mainly in vegetable oils such as safflower, sunflower, sesame, soybean, and corn oils. Polyunsaturated fat is also the main fat found in seafood. Eating polyunsaturated fat in place of saturated fat may lower LDL cholesterol.

The two types of polyunsaturated fats are omega-3 and omega-6 fatty acids.

iii. Trans fat:

This is a fat that has been changed by a process called hydrogenation. This process increases the shelf life of fat and makes the fat harder at room temperature. Some animal-based foods have small amounts of naturally occurring trans fats. Most trans fat comes from partially hydrogenated oils (PHOs).

Q4. Write the effects of vitamins A, C and D.

Ans: Vitamins:

The chemicals that are required in low amounts but are essential for normal growth and metabolism are called vitamins.

Vitamins are organic substances. We need small amount of vitamins for good health. Vitamins come from food or made by the bacteria that live in our intestine. Vitamins play an important role in metabolism. Some vitamins are soluble in fat e.g., vitamin A, C, and D.

Effects of Vitamin A:

Vitamin A mainly occurs in carrots, papaya, mangoes, fish, milk, butter, eggs etc. It is needed for synthesis of visual pigments rhodopsin of rod cells and iodopsin of cone cells for eyesight. It is responsible for maintenance of healthy skin, hair and mucous membrane and for proper bone growth.

Deficiency of Vitamin A leads to night blindness, retarded growth of bones, teeth and muscles.

Effects of Vitamin C or Ascorbic Acid:

Vitamin C is widely distributed in citrus fruits e.g., oranges, lemons, grape fruit, black currents and leafy green vegetables, tomatoes, potatoes and cabbage. Milk contains very little vitamin C. It is needed for forming collagen. Vitamin C helps to maintain capillaries, bones and teeth. It aids in absorption of iron and synthesis of hormones.

Deficiency of Vitamin C causes scurvy.

Effects of Vitamin D:

Mainly Occurs in fish liver oil, milk, ghee, butter etc. It is also made in the skin when exposed to sunlight. Vitamin D regulates absorption of calcium and phosphorus by the intestine and their retention in the body and deposition in bones and teeth.

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Deficiency of Vitamin D causes increased loss of calcium ions in urine so no calcium is deposited in the bones. This causes rickets in children.

Q5. Write the effects of mineral: calcium and iron.

Ans: Minerals:

Minerals are inorganic elements. Only tiny quantity of trace elements is required in the daily diet. Man obtains minerals from food.

Calcium and iron are the major minerals.

i. Calcium:

Calcium is available in milk, cheese, egg yolk, beans, lentils, nuts, fig, cabbage etc. Calcium imparts strength and rigidity to bones and teeth. It is needed in muscle contraction and nerve conduction.

Low level of calcium causes spontaneous discharge of nerve fibres resulting in tetany (painful muscular cramp). Bones become soft and cause osteomalacia (adult) and rickets (in children). The low level of calcium slows blood clotting and healing of wounds.

ii. Iron:

Iron occurs in liver, heart, kidney, spleen, egg yolk, whole wheat, fish, nuts, dates, figs, beans, spinach etc. Iron performs a wide range of functions. Many of these functions are connected with oxidation, reduction process by which energy is conserved in the body.

It is a part of haemoglobin, so it is essential for transport of oxygen. The deficiency of iron causes anaemia (less haemoglobin) along with pale skin and fatigue.

Q6. How water and dietary fibre play important role for human health?

Ans: Water as an important role for human health:

It is essential constituent of protoplasm. About 70% of the body weight is water.

• **Sources of water:**

Sources of water are milk, juices, juicy fruits, vegetables, and natural water itself.

• **Functions of water:**

The following are the functions of water:

- Water is the medium of transport of nutrients, hormones and waste products.
- Water serves as a solvent in which chemical reactions take place.
- Water is the constituent of mucus in alimentary canal.
- Evaporation of water from sweating cools the body and thus prevents overheating.

• **Deficiency Symptoms of Water:**

The condition of severe loss of water from the body is known as dehydration. Severe dehydration can damage brain, kidney and cardiovascular system. It can be fatal if 20% of body water is lost.

Dietary fibres as an important role for human health:

Fibre is material present in food, which we are unable to digest. It is mostly cellulose. It is not considered as nutrient.

• **Sources of Fibre:**

Dietary fibre comes from plant foods. It is of two types. Soluble fibre from fruit pulp, vegetables, oat bran etc. Insoluble fibres from the cellulose of plant cell

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walls and the bran husk that cover wheat, rice and other cereal grains. Whole meal bread contains much more fibre than white bread because it is made from whole meal flour i.e., flour made from the whole grain.

- **Functions of Fibre:**

Insoluble fibre does not dissolve, but holds water and swells up if mixed with water. Insoluble fibre adds bulk of food. The muscles of intestine can work against it and help to pass food quickly.

- **Deficiency Symptoms of Fibre:**

If proper peristaltic movements do not occur, the undigested matter in the large intestine cannot move along fast enough and too much water will be absorbed and cause constipation.

Q7. Scurvy, night blindness, obesity are due to some deficiency or excess? Explain.

Ans: Cause of having scurvy:

Deficiency of Vitamin C causes scurvy. Scurvy is a disease which can lead to anemia, debility, exhaustion, spontaneous bleeding, pain in the limbs, and especially the legs, swelling in some parts of the body, and sometimes ulceration of the gums and loss of teeth.

Cause of having night blindness:

Deficiency of Vitamin A leads to night blindness, retarded growth of bones, teeth and muscles.

Night blindness (nyctalopia) is an inability to see well at night or in poor light such as in a restaurant or movie theater. It is often associated with an inability to quickly adapt from a well-illuminated to a poorly illuminated environment.

Cause of having obesity:

Excess of carbohydrates and fats in food causes obesity, which may also lead to high blood pressure.

Obesity is defined as abnormal or excessive fat accumulation that presents a risk to health. A body mass index (BMI) over 25 is considered overweight, and over 30 is obese.

Q8. Can you describe the structure of alimentary canal in your body?

Ans: Alimentary canal:

The digestive system of human consists of a long tube that extends from the mouth to the anus. This tube is called alimentary canal.

Structure of human alimentary canal:

Main sections of alimentary canal are:

- | | |
|---------------------|---------------------|
| i. Oral cavity | ii. Pharynx |
| iii. Oesophagus | iv. Stomach |
| v. Small intestines | vi. Large intestine |

Glands associated with the alimentary canal:

In addition there are many glands associated with the alimentary canal. These are the three pairs of salivary glands, the pancreas and the liver.

1 We will go through the structure and functioning of digestive system by assuming how a bite of bread 'roti' taken with some dish (like mutton) is digested and how small molecules like amino acids, simple sugars, fatty acids, vitamins, salts and water are provided to cells.

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Oral cavity – (Selection, grinding, partial digestion):

Functions of oral cavity:

(a) Food Selection:

Oral cavity is the space behind mouth and has many important functions in the whole process. **Food selection** is one of them. When food enters the oral cavity, it is tasted and felt. If the taste of mutton suggests that it is old, we reject it. If the teeth or tongue detect some hard object, such as dirt, we also reject that bite. The senses of smell and vision also help oral cavity in the selection of food.

(b) Grinding of food:

The second function of oral cavity is the grinding of food by teeth. It is known as chewing or **mastication**. This is useful first because the esophagus can pass only small pieces and secondly because enzymes cannot act on large pieces of food. They require small pieces with large surface areas to attack.

(c) Lubrication and chemical digestion of food:

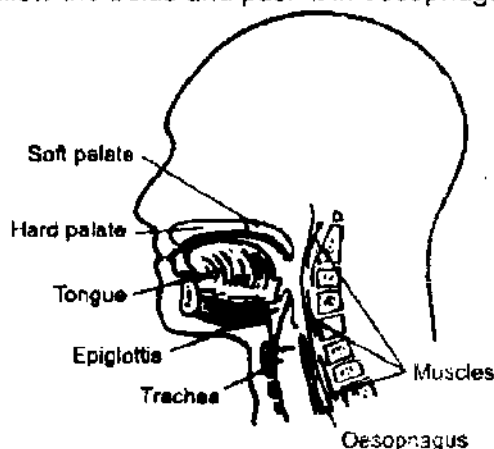
The third and fourth functions of the oral cavity are the **lubrication** and **chemical digestion** of food. The chewing process stimulates the three pairs of salivary glands (under the tongue, behind the jaws, and in front of ears) to release a juice called **saliva** in oral cavity.

Functions of Saliva:

Saliva has two main functions. First it adds water and mucous to the food which act as lubricant to ease the passage of food through oesophagus. Second, saliva contains an enzyme **salivary amylase**, which aids in the partial digestion of starch.

Bolus:

After the processes of chewing, lubrication, and partial digestion the pieces of bread and mutton are rolled up by the tongue into small, slippery, spherical mass called **bolus**. We swallow the bolus and push it in oesophagus through the pharynx.



Steps in swallowing

Pharynx and Oesophagus – (Swallowing and Peristalsis):

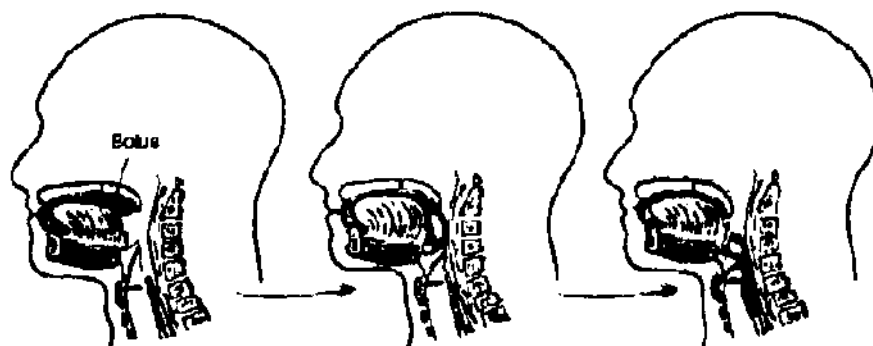
Steps in swallowing:

During swallowing, bolus is pushed to the back of mouth by tongue. When tongue pushes bolus, the soft palate also moves upward and to rear. In this way, the opening of nasal cavity is closed. When swallowed the bolus passes pharynx to

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enter oesophagus. Pharynx has adaptations to prevent the entry of bolus particles in trachea (wind pipe to lungs).

During swallowing, larynx (the top of trachea) moves upward and forces the epiglottis (a flap of cartilage) into horizontal position. Thus glottis i.e. the opening of trachea is closed. The beginning of swallowing action is voluntary, but once food reaches the back of mouth, swallowing becomes automatic.



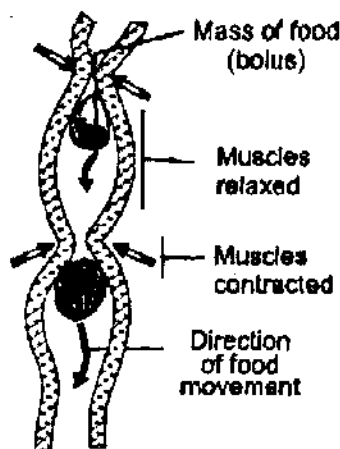
Steps in swallowing

After being swallowed, the food enters the tube called the oesophagus, which connects the pharynx to the stomach. Neither the pharynx nor the oesophagus contributes to digestion and the previous digestive actions of saliva continue.

In adult human, oesophagus is about 25 cm long.

Steps in Peristalsis:

Peristalsis moves the food from the oral cavity to the rectum. **Peristalsis** is defined as the rhythmic sequence of waves of contraction in the smooth muscles of the walls of alimentary canal, thus squeezing the food down along the alimentary canal.



Peristalsis

Stomach – (Digestion, churning, and melting):

The stomach is a dilated part of the alimentary canal. It is J-shaped, located in the left of the abdomen, just beneath the diaphragm.

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Portions of Stomach:

Stomach has two main portions.

i. **Cardiac portion:**

The cardiac portion is present immediately after oesophagus.

ii. **Pyloric portion:**

The pyloric portion is located beneath the cardiac portion. Stomach has two sphincters (openings which are guarded by muscles).

Cardiac sphincter and pyloric sphincter:

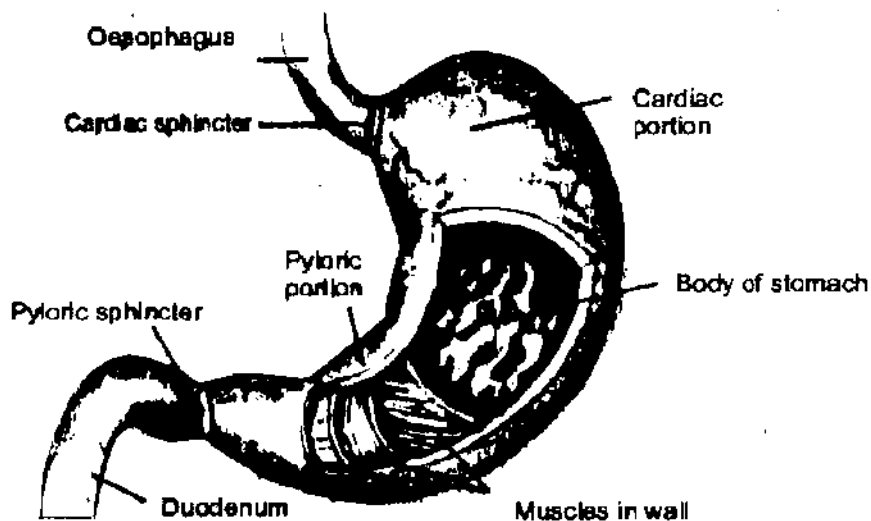
Cardiac sphincter is between stomach and oesophagus while pyloric sphincter is between stomach and small intestine. Bolus enters stomach from oesophagus through cardiac sphincter.

Entrance of Food in stomach:

When food enters stomach, the gastric glands found in the stomach wall are stimulated to secrete gastric juice. Gastric juice is composed chiefly of mucous, hydrochloric acid, and a protein-digesting enzyme pepsinogen.

Functions of Hydrochloric acid:

Hydrochloric acid converts the inactive enzyme pepsinogen into its active form i.e. pepsin. HCl also kills microorganisms present in food. Pepsin partially digests the protein portion of food (bulk of mutton) into polypeptides and shorter peptide chains.



Structure of stomach

Churning action:

In the stomach, food is further broken apart through a process of churning. The walls of the stomach contract and relax and these movements help in thorough mixing of the gastric juice and food. The churning action also produces heat which helps to melt the lipid content of the food.

Note: The starch in our bite of bread and the protein in mutton have been partially digested and the food has been converted to a soup-like mixture called chyme. After it, the pyloric sphincter allows a little mass of chyme to enter duodenum.

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Some quantity of gastric juice is always present in stomach. When bite is in oral cavity, brain sends messages to stomach walls to secrete some gastric juice. When food reaches stomach, more gastric juice is secreted according to needs. If there is little or no protein in food, stomach does not secrete more gastric juice. On the other hand, if more proteins are present in food, abundant gastric juice is secreted. In this case, already present gastric juice begins the digestion of huge proteins into peptides. These peptides stimulate some cells of stomach walls to release a hormone called **gastrin**. This hormone enters blood and is distributed to all parts of body. In stomach, it has specific effect and stimulates the gastric glands to secrete more gastric juice.

Small Intestine – (Complete digestion and absorption):

Function of Small Intestine:

Duodenum comprises of the first 10 inches (25 cm) of the small intestine and it is the part of the alimentary canal where most of the digestive process occurs. Here the food is further mixed with 3 different secretions;

1. **Bile** from liver helps in fat digestion through emulsification.
2. **Pancreatic juice** from pancreas contains enzymes **trypsin**, **pancreatic amylase** and **lipase** which digest proteins, carbohydrates and lipids respectively.
3. **Intestinal juice** from the intestine walls contains many enzymes for the complete digestion of all kinds of food.

Jejunum:

Next to the duodenum is 2.4 meters long **jejunum**. It is concerned with the rest of the digestion of the proteins, starch and lipids of our bite.

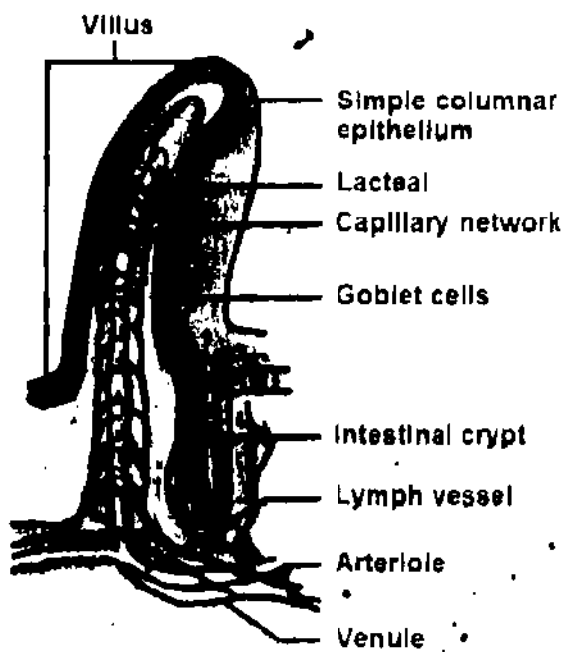
Function of Ileum:

Last 3.5 meters long part of the small intestine is the **ileum**. It is concerned with the absorption of digested food.

Function of Villi:

There are circular folds in the inner wall of the **ileum**. These folds have numerous fingerlike projections called **villi** (singular: villus). The villi increase the surface area of the inner walls and it helps a lot in the absorption of digested food.

Each villus is richly supplied with blood **capillaries** and a vessel of lymphatic system, called **lacteal**. The walls of the villus are only single-cell thick. The digested molecules i.e. **simple sugars** and **amino acids** are absorbed from the intestine into the blood capillaries present in villi. The blood carries them away from the small intestine via the **hepatic portal vein** and goes to the liver for filtering, removal of toxins, and nutrient.



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processing. Fatty acids and glycerol are absorbed into the lymphatic vessel (lacteal) present in villi, which carries them to the main lymphatic duct, from where they enter in bloodstream.

Large intestine – (Absorption of water and defecation)

After the digested products of our bite have been absorbed in blood, the remaining mass enters the large intestine.

Parts of Large intestine:

It has 3 parts;

- (a) The caecum (or pouch that forms the T-junction with the small intestine).
- (b) The Colon.
- (c) The rectum.

From colon water is absorbed into blood. As the water is absorbed, the solid remains of the food are called **faeces**. The faeces contain the undigested material.

A large number of bacteria, sloughed off cells of the alimentary canal, bile pigments and water are also part of the faeces. Faeces are temporarily stored in the rectum, which opens out through anus. Under normal conditions when the rectum is filled up with faeces, it gives rise to a reflex and anus is opened for defecation.

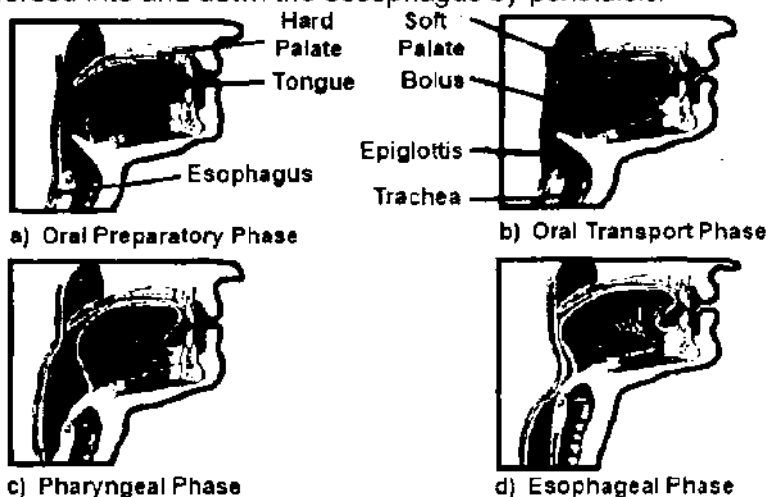
Q9. Describe the process of swallowing food in man with diagram.

Ans: Swallowing:

In swallowing the following actions take place:

- (a) The tongue presses upwards and back against the roof of the mouth forcing a bolus, to the back of the mouth.
- (b) The soft palate closes the nasal cavity at the back.
- (c) The larynx cartilage around the top of the trachea is pulled upwards so that glottis (opening of trachea) lies under the back of the tongue.
- (d) The glottis is also partly closed by the contraction of a ring muscle.
- (e) The epiglottis (a flap of cartilage) helps to prevent the food from entering glottis instead of oesophagus.

The beginning of the swallowing action is voluntary, but once the food reaches the back of the mouth, swallowing becomes an automatic or reflex action. The food is forced into and down the oesophagus by peristalsis.



The process of swallowing in-man

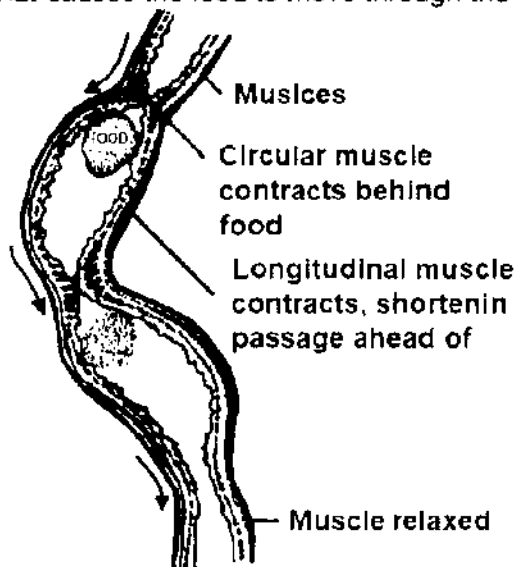
BIOLOGY NOTES FOR 9TH CLASS

Q10. Describe peristalsis with diagram.

Ans: Peristalsis:

The alimentary canal has layers of muscle in its wall which pushes the ingested food forward. A contraction of muscle just behind the food mass pushes the food forward into the next region where muscles are relaxed and oesophagus is wide. This wave of contraction is called peristalsis.

It is the rhythmic wave of muscular contraction and relaxation in the wall of the alimentary canal that causes the food to move through the alimentary canal.



Peristalsis

Q11. Describe the process of digestion. How it takes place in your body?

Ans: DIGESTION IN MAN:

A man like all other animals needs energy for the maintenance of his life processes. The energy comes from the metabolism of food substances. The food consists of carbohydrates, proteins, and fats. These are very large molecules. Every cell of the body needs these molecules for their proper functioning. Digestive system performs ingestion, digestion, absorption, assimilation and egestion.

Taking in of the food is called ingestion. The breakdown of large food molecules, into small soluble food molecules with the help of enzymes is called digestion.

IDENTIFICATION AND FUNCTIONS OF THE MAIN REGIONS OF HUMAN ALIMENTARY CANAL:

The organs, which take part in the process of digestion, make the digestive system. The human digestive system consists of two sets of organs.

1. The alimentary canal is concerned with ingestion, digestion, absorption and egestion of undigested food. The parts of the alimentary canal are mouth, oral cavity, pharynx, oesophagus, stomach, small intestine and large intestine.
2. The digestive glands are associated with the alimentary canal and help in digestion. The digestive glands are: salivary glands, gastric glands, intestinal glands, liver and pancreas.

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1. Alimentary Canal

Alimentary canal is also known as gut or digestive tract or gastrointestinal tract. It is a continuous tube. The tube is about 9 meters long in adult. It is specialized at various points along its length, with each region designed to carry out a different role in the overall process of digestion, absorption and egestion.

Alimentary canal begins from the mouth and ends at the anus. It is lined internally by mucous membrane.

Mouth:

It is the external opening that leads into the oral cavity or mouth cavity.

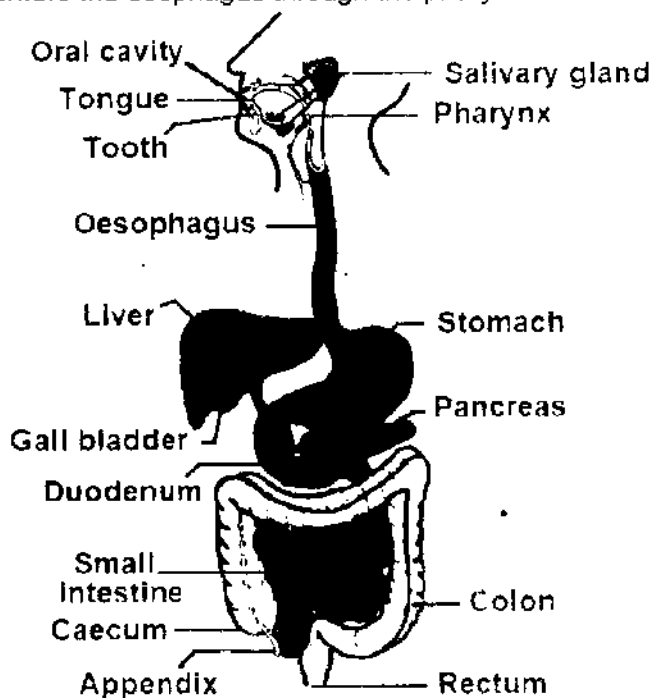
Oral Cavity:

Around the sides and front of the oral cavity are the upper and lower jaws. The upper jaw is fixed while the lower is movable. The oral cavity contains teeth and tongue.

1. Digestion in the Oral Cavity:

Here food is tasted, smelled and felt. The food is chewed by crushing and grinding. The teeth, cheeks and tongue take part in these actions. As a result, food is physically and quickly broken down into smaller pieces. Food in the oral cavity stimulates the salivary glands to secrete saliva.

The water and mucin in saliva moistens, softens and lubricates food. Saliva contains salivary amylase. This enzyme digests starch and maltose. The food is rolled by the tongue into small, slippery, spherical mass called bolus. The bolus is swallowed and enters the esophagus through the pharynx.



The Human digestive system

Pharynx:

It leads from the mouth to the oesophagus and to the trachea. The pharynx is a common passage for food and air.

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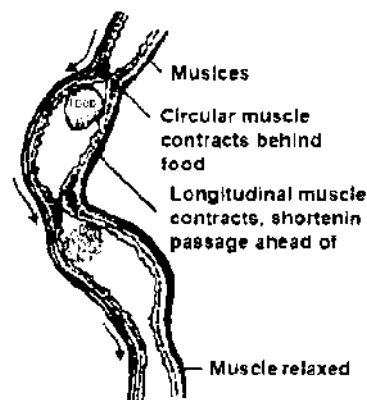
Oesophagus:

It is muscular tube, about 25 cm long. It leads from pharynx to the stomach. In oesophagus no digestion takes place.

Peristalsis:

The alimentary canal has layers of muscle in its wall which pushes the ingested food forward. A contraction of muscle just behind the food mass pushes the food forward into the next region where muscles are relaxed and oesophagus is wide. This wave of contraction is called peristalsis.

It is the rhythmic wave of muscular contraction and relaxation in the wall of the alimentary canal that causes the food to move through the alimentary canal.



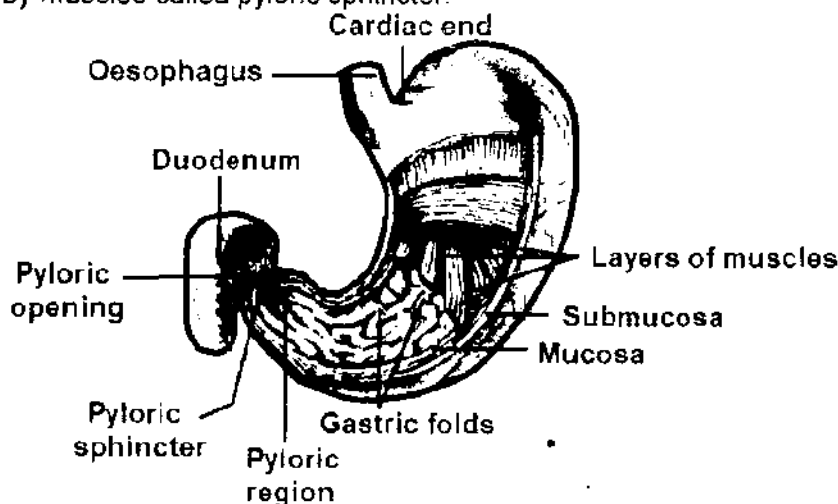
Peristalsis

Stomach:

The stomach is the dilated part of the digestive tube. It is roughly J shaped and somewhat transversely placed on the left of the abdomen just beneath the diaphragm. It has two openings, which are guarded by valves.

The opening between oesophagus and stomach is called cardiac opening, which is guarded by cardiac sphincter. The region of the stomach around the cardiac opening is the cardiac end.

The opening of stomach into the duodenum is called pyloric opening which is guarded by muscles called pyloric sphincter.



Structure of Stomach

Digestion in Stomach:

On the peristaltic reflex the cardiac sphincter relaxes to allow food in the stomach.

Gastric Juice:

The food in the stomach stimulates the gastric glands to secrete gastric juice. It consists of mucin, HCl, pepsin and rennin.

BIOLOGY NOTES FOR 9TH CLASS

Mucin:

Mucin forms a coating over the stomach. It neutralizes the acid. It prevents the digestion of stomach wall by the enzyme pepsin.

Hydrochloric Acid:

HCl performs the following functions:

- a. Stops the action of salivary amylase.
- b. It converts the inactive form of enzyme (pepsinogen) to active form (pepsin). It provides acidic medium suitable for the action of enzymes.
- c. It kills many microorganisms.

Pepsin:

It is secreted as inactive pepsinogen. HCl or already present pepsin converts it to pepsin. Pepsin digests proteins to polypeptides (chain of many amino acids) and peptides (chain of few amino acids).

Rennin:

Rennin is secreted only in infants. It helps in the digestion of milk protein.

By the churning action of stomach wall, the food mixed into a soupy mixture called chyme. When the chyme reaches a certain degree of acidity the pylorus relaxes and a little food passes into the duodenum.

Small Intestine:

The small intestine is small in diameter. It is divided into three parts: duodenum, jejunum and ileum. Duodenum is about 20-25cm long. Bile duct from gall bladder, hepatic duct from liver and pancreatic duct from pancreas empty its secretions, in the duodenum. Jejunum is about 2.5 meters long and ileum about 4 meters long.

Digestion in the Small intestine:

Starch, proteins and fats are all enzymatically broken down in the small intestine. When food enters the duodenum the chyme stimulates:

- a. The gall bladder to release bile.
- b. The pancreas to secrete pancreatic juice.
- c. The intestinal glands to secrete intestinal juice.

All these secretions are alkaline and neutralize the acidic chyme. The pancreatic and intestinal enzymes can work only in this alkaline medium.

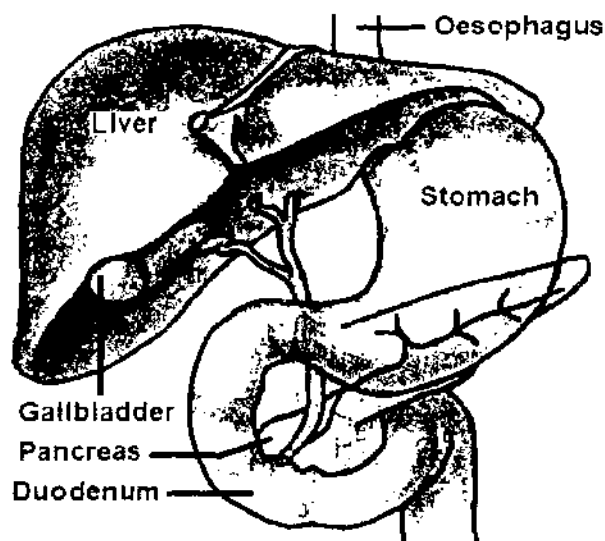
Bile:

Bile is a greenish yellow liquid manufactured in the liver. Bile is stored in the gallbladder and is released whenever food enters the duodenum. Bile emulsifies fats causing them to break down into small droplets called emulsion. Emulsification provides relatively large surface areas of lipid for the action of lipase enzymes.

Pancreatic Juice:

The secretion of pancreas is called pancreatic juice. It contains enzymes amylase, lipase and trypsinogen. Pancreatic amylase is the starch-digesting enzyme. It converts polysaccharides to maltose and even to glucose. Pancreatic lipase converts neutral fats into glycerol and fatty acids. Trypsin converts proteins into polypeptides.

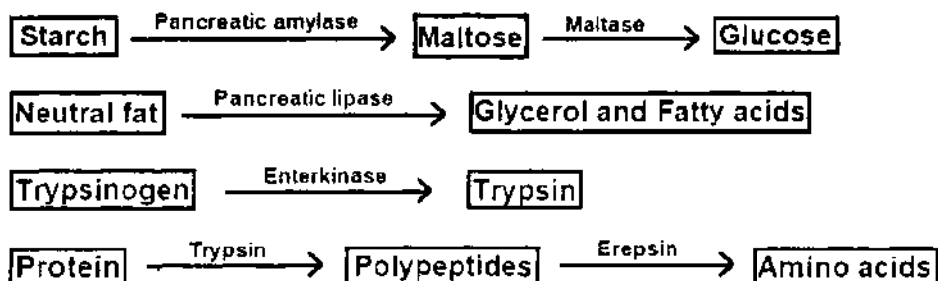
BIOLOGY NOTES FOR 9TH CLASS



Liver, Gall bladder and pancreas

Digestion in Jejunum and Ileum:

The lining of the jejunum and ileum secrete several enzymes such as erepsin converts peptides into amino acids. It secretes Enterokinase which activates pancreatic trypsinogen into its active form trypsin. Lactase converts lactose to glucose. Maltase converts maltose to glucose etc. In the ileum digestion process is complete.



Absorption in the Small Intestine:

The internal lining of small intestine is modified to tiny finger like projections called villi. Each villus contains number of blood capillaries and a lymph vessel called lacteal. The villi increase surface area for absorption.

Q12. Write symptoms, causes, treatment and prevention of the following disorder of gut:

- | | |
|------------------|------------------|
| (a) Diarrhoea | (b) Constipation |
| (c) Appendicitis | (d) Ulcer |

Ans:

(a) Diarrhoea:

Diarrhoea is a condition in which the sufferer has frequent watery, loose bowel movements.

Signs and symptoms of Diarrhoea:

The symptoms of diarrhoea are that the stool becomes watery. There is increased frequency of defecation.

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Causes of Diarrhoea:

The major causes are infection of the lower GI tract and nervous stimulation. In case of infection such as food poisoning caused by eating contaminated food the intestinal wall becomes irritated and peristalsis increases. Diarrhoea results in dehydration, so ORS (oral rehydration solution), or mixture of salt and sugar solution is given.

Recovery of Diarrhoea:

If sufficient food and water is available a patient recovers from Diarrhoea in a few days. However, for malnourished individuals Diarrhoea can lead to severe dehydration and can become life-threatening.

Treatment of Diarrhoea:

The treatment for Diarrhoea involves consuming adequate amounts of water to replace the loss, preferably mixed with electrolytes to provide essential salts and some amount of nutrients. Antibiotics may be required if Diarrhoea is due to bacterial infection.

Preventions of Diarrhoea:

Preventions of Diarrhoea include taking proper water and electrolytes, eating regularly and taking hygienic measures.

(b) Constipation:

Constipation is a condition where a person experiences hard faeces that are difficult to eliminate.

Signs and Symptoms of constipation:

The symptoms include decrease in frequency of stools daily, or difficulty in defecation, may result in abdominal pain.

Causes of Constipation:

The main causes of constipation include hardening of the faeces due to excessive absorption of water through colon, insufficient intake of dietary fibre, dehydration, use of medicines (e.g. those containing iron, calcium, and aluminium), injured anal sphincter, and tumours in the rectum or anus.

The faeces move too slowly along the large intestine. As a result, more water is absorbed from the faeces than usual. The faeces become hard so defecation become difficult and painful. Constipation is called the mother of all diseases.

Treatment of constipation:

For the treatment of constipation laxative is taken to make the faeces soft to be discharged easily.

Prevention of constipation:

As a preventive measure one should take plenty of water or fluids and fibrous food, fruits, vegetables etc.

(c) Appendicitis:

Appendicitis is an inflammation of the appendix, a 6-10 cm long tube of tissue, that extends from the large intestine. The appendix contains specialized tissue that can produce antibodies, but no one is absolutely certain what its function is.

Signs and Symptoms of appendicitis:

The classic symptoms of appendicitis include dull pain near the navel or the upper abdomen that becomes sharp as it moves to the lower right abdomen. This is usually the first sign.

BIOLOGY NOTES FOR 9TH CLASS

Causes of appendicitis:

Appendicitis occurs when the appendix becomes blocked, often by stool, a foreign body, or cancer. Blockage may also occur from infection, since the appendix swells in response to any infection in the body.

Treatment of appendicitis:

Surgery to remove the appendix, which is called an appendectomy, is the standard treatment for appendicitis.

Prevention of appendicitis:

There is no way to prevent appendicitis. However, appendicitis is less common in people who eat foods high in fiber, such as fresh fruits and vegetables.

(d) Ulcer:

An ulcer is an open sore in the wall of the gut caused by the gradual disintegration of the tissue. It may be gastric (stomach) ulcer or peptic (duodenal) ulcer.

Signs and Symptoms of ulcer:

The main symptom of ulcer is stomach pain.

Causes of ulcer:

The causes of ulcer are acidity, smoking, and bacterial infection.

Treatment of ulcer:

Medicines to be taken as prescribed by the physician.

Prevention of ulcer:

For the prevention of ulcer:

- i. stop smoking.
- ii. avoid spicy food and food containing acids.
- iii. avoid stress.

Q13. What role liver plays in your body?

Ans: Liver:

It is the largest gland, dark reddish in colour. The liver lies immediately below the diaphragm to the right side of the body. Liver secretes bile. It is collected by hepatic duct. In the gallbladder bile is temporarily stored. When the gallbladder contracts bile is poured into the duodenum.

Role of liver:

The main functions of liver are:

- i. The liver cells manufacture bile.
- ii. Excess of glucose is stored by the liver as glycogen.
- iii. Liver converts glycerol and amino acids to glucose molecules.
- iv. Liver removes amino group from amino acids. It is called deamination.
- v. Ammonia is converted into urea in the liver.
- vi. Majority of the plasma proteins are synthesized in the liver.
- vii. Destroys old red blood cells
- viii. Stores fat-soluble vitamins (A, D, E and K) and mineral ions such as iron.

BIOLOGY NOTES FOR 9TH CLASS

THE TERMS TO KNOW

1. **Amylase:** An enzyme in saliva and pancreatic juice that aids in the semi-digestion of starch.
2. **Anemia:** The lack of blood; caused when the number of red blood cells is reduced than the normal.
3. **Appendix:** Anon-functional finger-like process attached at the blind end of caecum.
4. **Assimilation:** The incorporation of the products of digestion into the body, where they are used to provide energy or for growth and repair of tissues.
5. **Balanced diet:** The diet which contains all the essential nutrients like, carbohydrates, fats, proteins, minerals, vitamins in the correct proportion for the normal growth and development of the body.
6. **Bolus:** The small, slippery, spherical mass of food formed in the oral cavity during the processes of mastication, lubrication, and semi-digestion.
7. **Cardiac sphincter:** The opening between oesophagus and the cardiac portion of, the stomach (sphincter means an opening which are guarded by muscles).
8. **Chyme:** The soup-like mixture formed after the action of stomach on food.
9. **Colon:** The major part of the large intestine.
10. **Constipation:** The condition where a person experiences hard faeces that is difficult to eliminate.
11. **Diarrhoea:** The disease when required water is not absorbed in blood from the colon and watery stools result.
12. **Dietary fibre:** The part of human food from plant material that remains indigestible.
13. **Digestion:** The process in which the large and non-diffusible food molecules are broken down into smaller and diffusible molecules (that can cross the membranes).
14. **Duodenum:** The first 10 inches (25 cm) of the small intestine.
15. **Emulsification:** The process by which bile salts keep lipid droplets separate from one another.
16. **Epiglottis:** The flap of cartilage on the glottis (opening of the trachea in pharynx).
17. **Famine:** The lack of enough food to feed all the people living in an area.
18. **Fat-soluble vitamins:** The fat-soluble vitamins are soluble in lipids (fats). Fat-soluble (vitamins A, D, E and K).
19. **Fertilizer:** The material which is added to soil for desirable characteristics.
20. **Gastric juice:** The secretion of the gastric glands of stomach; composed of water, mucous, hydrochloric acid, and pepsinogen.
21. **Goiter:** The condition in which the thyroid gland becomes enlarged due to insufficient amount of iodine in diet.
22. **Ileum:** The last 3.5 meters long part of the small intestine; concerned with the absorption of digested food.

BIOLOGY NOTES FOR 9TH CLASS

- =====
23. **Gastrin:** The hormone secreted by special cells in stomach walls by the stimulation of peptides present in food; gastrin stimulates the cells of gastric glands to secrete more gastric juice.
 24. **Oesophagus:** The long tube (25 cm in adult human) which connects pharynx with stomach.
 25. **Intestinal juice:** The secretion from the intestine walls contains many enzymes for the complete digestion of all kinds of food.
 26. **Jejunum:** The 2.4 meters long part of small intestine present after duodenum.
 27. **Kwashiorkor:** Disease due to protein deficiency; the patient may grow to normal height but are abnormally thin.
 28. **Lacteal:** A vessel of lymphatic system present in the villus.
 29. **Laxatives:** The medicines given to relieve constipation.
 30. **Lipase:** The enzyme that digests proteins.
 31. **Liver:** The largest gland of the body; secretes bile into the duodenum and performs many other important functions.
 32. **Malnutrition:** Problems related to nutrition are grouped as malnutrition.
 33. **Marasmus:** Disease due to protein deficiency; the patient lose all their muscle strength and acquire a skeletal appearance.
 34. **Mineral deficiency diseases:** Diseases resulting from the deficiency of a mineral e.g. i. Goiter ii. Anemia
 35. **Nutrition:** The process in which food is obtained or prepared, absorbed and converted into body substances for growth and energy.
 36. **Oral cavity:** The first part of the alimentary canal; the space behind mouth.
 37. **Over intake of nutrients:** Over-intake of nutrients (OIN) is a form of malnutrition in which more nutrients are taken than the amounts required for normal growth, development, and metabolism.
 38. **Pancreas:** The gland that secretes pancreatic juice in duodenum; also produces insulin hormone.
 39. **Pancreatic juice:** The secretion of the pancreas that contains enzymes trypsin, pancreatic amylase and lipase.
 40. **Pepsin:** The active form of enzyme pepsinogen that partially digests the proteins into shorter peptide chains.
 41. **Pepsinogen:** The inactive enzyme present in gastric juice; activated into pepsin by HCl.
 42. **Peristalsis:** The rhythmic sequence of waves of contraction in the smooth muscles of the walls of alimentary canal, thus squeezing the food down along the alimentary canal.
 43. **Pharynx:** The section of alimentary canal after oral cavity and before oesophagus.
 44. **Protein-energy malnutrition:** Protein-energy malnutrition refers to inadequate availability or absorption of energy and proteins in the body. It may lead to diseases such as: i. Kwashiorkor ii. Marasmus
 45. **Pyloric sphincter:** The opening between the pyloric portion and small intestine.
 46. **Rectum:** The last part of the large intestine; opens out through anus.

BIOLOGY NOTES FOR 9TH CLASS

- =====
- 47. **Saliva:** The secretion from the salivary glands; contains, water, mucous and amylase enzyme.
 - 48. **Starvation:** Starvation is a severe reduction in nutrient and energy intake and is the most horrible effect of malnutrition.
 - 49. **Stomach:** The dilated part of the alimentary canal, in the left of the abdomen, beneath the diaphragm.
 - 50. **Swallowing:** During swallowing the bolus is pushed to the back of the mouth by the tongue.
 - 51. **Trace minerals:** The mineral in human food that is required in amounts less than 100 mg per day.
 - 52. **Trypsin:** The enzyme present in pancreatic juice; for the digestion of proteins.
 - 53. **Ulcer:** A sore in the gut lining caused by a gradual breakdown of the tissue by the acidic gastric juice.
 - 54. **Villus:** The finger-like projection present on the inner walls of the ileum.
 - 55. **Vitamins:** The chemicals that are required in low amounts but are essential for normal growth and metabolism.
 - 56. **Water-soluble vitamins:** Water-soluble vitamins are absorbed directly in the blood, travel freely; excess is excreted in the urine, and is needed in frequent doses (1-3 days) e.g. B-complex and Vitamin C.

MULTIPLE CHOICE QUESTIONS

- 1. **What are the primary nutrient that provides quick useable energy for the body?**
 - A. Carbohydrates
 - B. Proteins
 - C. Lipids
 - D. Nucleic acids
- 2. **The wavelike movement of muscle that pushes food through the digestive system is called;**
 - A. Chemical digestion
 - B. Emulsification
 - C. Absorption
 - D. Peristalsis
- 3. **Micronutrients of plants are;**
 - A. Available in the soil only in small amounts
 - B. Required by plants in small amounts
 - C. Small molecules required by plants
 - D. Useful, but not required by plants
- 4. **Which of the following does not occur in the oral cavity?**
 - A. Lubrication of the food
 - B. Beginning of protein digestion
 - C. Breaking the food into small fragments
 - D. All of the above do occur in the oral cavity
- 5. **Where are villi found?**
 - A. Esophagus
 - B. Stomach
 - C. Small intestine
 - D. Large intestine

BIOLOGY NOTES FOR 9TH CLASS

- =====
6. **Ulcer occur in;**
A. Stomach B. Duodenum
C. Esophagus D. All of these
7. **Which group of enzymes breaks up starches and other carbohydrates?**
A. Proteases B. Lipases
C. Amylases D. None of these
8. **Pancreas produces digestive enzymes and releases them into the;**
A. Colon B. Gallbladder
C. Liver D. Duodenum
9. **In stomach, pepsinogen is converted into;**
A. Pepsin B. Bicarbonate
C. HCl D. Gastrin
10. **Hepatic portal vein carries blood from the _____ to the _____.**
A. Small intestines, liver B. Small intestines, heart
C. Liver, heart D. Small intestines, colon
11. **Which of the following is not a function of the liver?**
A. Converts glucose to glycogen
B. Converts glycogen to glucose
C. Manufactures fibrinogen
D. Produces digestive enzymes
12. **The diseases of Kwashiorkor and marasmus may be due to;**
A. Mineral deficiency B. Over-intake of nutrients
C. Protein-energy malnutrition D. Ulcer
13. **Which food group is our body's best source of energy?**
A. Meat Group B. Fats, oils and sweets
C. Breads and cereals D. Milk and cheese
14. **What may be the reason that children need more calcium and iron?**
A. Both calcium and iron for bones
B. Both calcium and iron for blood
C. Calcium for blood and iron for bones
D. Calcium for bones and iron for blood
15. **The process of breaking down large droplets of fat into small droplets is called;**
A. Emulsification B. Absorption
C. Peristalsis D. Digestion

ANSWERS:

1. A	2. D	3. B	4. B	5. C
6. D	7. C	8. D	9. A	10. A
11. D	12. C	13. C	14. D	15. A

BIOLOGY NOTES FOR 9TH CLASS

MULTIPLE CHOICE QUESTIONS

- 1. The lack of blood; caused when the number of red blood cells is reduced than the normal:**

A. Marasmus	B. Goiter
C. Anemia	D. Kwashiorkor
- 2. A non-functional finger-like process attached at the blind end of caecum:**

A. Colon	B. Appendix
C. Duodenum	D. Chyme
- 3. The chemicals that are required in low amounts but are essential for normal growth and metabolism:**

A. Vitamins	B. Enzymes
C. Lipids	D. Carbohydrates
- 4. The small, slippery, spherical mass of food formed in the oral cavity during the processes of mastication, lubrication, and semi-digestion:**

A. Bolus	B. Colon
C. Chyme	D. Duodenum
- 5. The opening between oesophagus and the cardiac portion of, the stomach (sphincter means an opening which are guarded by muscles):**

A. Oral cavity	B. Cardiac sphincter
C. Pyloric sphincter	D. Peristalsis
- 6. The soup-like mixture formed after the action of stomach on food:**

A. Colon	B. Duodenum
C. Chyme	D. Appendix
- 7. The major part of the large intestine:**

A. Gallbladder	B. Liver
C. Esophagus	D. Colon
- 8. The condition where a person experiences hard faeces that are difficult to eliminate:**

A. Constipation	B. Digestion
C. Duodenum	D. Emulsification
- 9. The disease when required water is not absorbed in blood from the colon and watery stools result:**

A. Diarrhoea	B. Constipation
C. Cholera	D. Ulcer
- 10. The part of human food from plant material that remains indigestible:**

A. Famine	B. Dietary fibre
C. Poly fiber	D. Peristalsis

BIOLOGY NOTES FOR 9TH CLASS

- =====
11. The process in which the large and non-diffusible food molecules are broken down into smaller and diffusible molecules that can cross the membranes:
- | | |
|-------------------|-----------------|
| A. Emulsification | B. Constipation |
| C. Digestion | D. Famine |
12. The first 10 inches (25 cm) of the small intestine:
- | | |
|--------------|-------------|
| A. Chyme | B. Colon |
| C. Esophagus | D. Duodenum |
13. The process by which bile salts keep lipid droplets separate from one another:
- | | |
|--------------|-------------------|
| A. Laxatives | B. Gastrin |
| C. Jejunum | D. Emulsification |
14. The flap of cartilage on the glottis (opening of the trachea in pharynx):
- | | |
|---------------|--------------|
| A. Bolus | B. Colon |
| C. Epiglottis | D. Esophagus |
15. The lack of enough food to feed all the people living in an area:
- | | |
|-------------|------------|
| A. Marasmus | B. Famine |
| C. Jejunum | D. Cuticle |
16. The finger-like projection present on the inner walls of the ileum:
- | | |
|----------|------------|
| A. Colon | B. Villus |
| C. Chyme | D. Jejunum |
17. The secretion of the gastric glands of stomach; composed of water, mucous, hydrochloric acid, and pepsinogen:
- | | |
|------------------|--------------|
| A. Lipases | B. Amylases |
| C. Gastric juice | D. Proteases |
18. The hormone secreted by special cells in stomach walls by the stimulation of peptides present in food; gastrin stimulates the cells of gastric glands to secrete more gastric juice:
- | | |
|------------|-----------|
| A. Gastrin | B. Pepsin |
| C. Saliva | D. Chyme |
19. The opening of the trachea in pharynx:
- | | |
|--------------|------------|
| A. Glottis | B. Goiter |
| C. Esophagus | D. Gastrin |
20. The condition in which the thyroid gland becomes enlarged due to insufficient amount of iodine in diet:
- | | |
|-----------|------------|
| A. Anemia | B. Goiter |
| C. Ulcer | D. Obesity |
21. The last 3.5 meters long part of the small intestine; concerned with the absorption of digested food:
- | | |
|----------|--------------|
| A. Colon | B. Villus |
| C. Ileum | D. Esophagus |
22. The secretion from the intestine walls contains many enzymes for the complete digestion of all kinds of food:
- | | |
|------------------|---------------------|
| A. Gastric Juice | B. Pepsin |
| C. Gastrin | D. Intestinal juice |

BIOLOGY NOTES FOR 9TH CLASS

- =====
23. The 2.4 meters long part of small intestine present after duodenum:
A. Villus B. Ileum
C. Jejunum D. Colon
24. Disease due to protein deficiency; the patient may grow to normal height but are abnormally thin:
A. Marasmus B. Kwashiorkor
C. Anemia D. Ulcer
25. A vessel of lymphatic system present in the villus:
A. Lacteal B. Laxatives
C. Marasmus D. Obesity
26. The medicines given to relieve constipation:
A. Laxatives B. Chyme
C. Rectum D. Lacteal
27. The enzyme that digests proteins:
A. Pepsin B. Lipase
C. Amylases D. Proteases
28. The largest gland of the body; secretes bile into the duodenum and performs many other important functions:
A. Stomach B. Esophagus
C. Liver D. Colon
29. The enzyme present in pancreatic juice; for the digestion of proteins:
A. Pepsin B. Chyme
C. Colon D. Trypsin
30. Disease due to protein deficiency; the patient lose all their muscle strength and acquire a skeletal appearance:
A. Marasmus B. Anemia
C. Kwashiorkor D. Diarrhoea
31. The elements which are required in lower quantities:
A. Macronutrients B. Micronutrients
C. Nutrients D. Marasmus
32. The elements and compounds that an organism obtains and use as energy source or as components for the synthesis of new materials:
A. Micronutrients B. Minerals
C. Nutrients D. Macronutrients
33. The process in which food is obtained or prepared, absorbed and converted into body substances for growth and energy:
A. Macronutrients B. Micronutrients
C. Nutrients D. Nutrition
34. Becoming over-weight; one reason is the intake of food that contains energy more than their requirement and do very little physical work:
A. Glottis B. Gastrin
C. Marasmus D. Obesity

BIOLOGY NOTES FOR 9TH CLASS

- =====
35. The long tube (25 cm in adult human) which connects pharynx with stomach:
A. Esophagus B. Duodenum
C. Epiglottis D. Bolus
36. The first part of the alimentary canal; the space behind mouth:
A. Duodenum B. Oral cavity
C. Epiglottis D. Esophagus
37. The gland that secretes pancreatic juice in duodenum; also produces insulin hormone:
A. Gallbladder B. Glottis
C. Bolus D. Pancreas
38. The secretion of the pancreas that contains enzymes trypsin, pancreatic amylase and lipase:
A. Amylases B. Pancreatic juice
C. Pepsin D. Proteases
39. The active form of enzyme pepsinogen that partially digests the proteins into shorter peptide chains:
A. Trypsin B. Colon
C. Pepsin D. Chyme
40. The inactive enzyme present in gastric juice; activated into pepsin by HCl:
A. Trypsin B. Colon
C. Pepsin D. Pepsinogen
41. The rhythmic sequence of waves of contraction in the smooth muscles of the walls of alimentary canal, thus squeezing the food down along the alimentary canal:
A. Pyloric sphincter B. Peristalsis
C. Pepsin D. Pharynx
42. The section of alimentary canal after oral cavity and before oesophagus:
A. Glottis B. Gastrin
C. Bolus D. Pharynx
43. The opening between the pyloric portion and small intestine:
A. Pepsin B. Pyloric sphincter
C. Pharynx D. Peristalsis
44. The last part of the large intestine; opens out through anus:
A. Duodenum B. Esophagus
C. Rectum D. Stomach
45. The secretion from the salivary glands; contains, water, mucous and amylase enzyme:
A. Saliva B. Pepsin
C. Amylases D. Trypsin
46. The dilated part of the alimentary canal, in the left of the abdomen, beneath the diaphragm:
A. Liver B. Rectum
C. Stomach D. Villus

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BIOLOGY NOTES FOR 9TH CLASS

47. The mineral in human food that is required in amounts less than 100 mg per day:
- A. Trace minerals
B. Nutrients
C. Macronutrients
D. Micronutrients
48. An enzyme in saliva and pancreatic juice that aids in the semi-digestion of starch:
- A. Lipases
B. Proteases
C. Pepsin
D. Amylase

ANSWERS:

1. C	2. B	3. A	4. A	5. B	6. C
7. D	8. A	9. A	10. B	11. C	12. D
13. D	14. C	15. B	16. B	17. C	18. A
19. A	20. B	21. C	22. D	23. C	24. B
25. A	26. A	27. B	28. C	29. D	30. A
31. B	32. C	33. D	34. D	35. A	36. B
37. D	38. B	39. C	40. D	41. B	42. D
43. B	44. C	45. A	46. C	47. A	48. D

BIOLOGY NOTES FOR 9TH CLASS

UNIT-09

TRANSPORT

CHAPTER WISE NOTES

Q1. State the role of transport in plants.

Ans: In plants oxygen and carbon dioxide are exchanged directly with the environment through stomata of leaves. A plant gets water, minerals and some oxygen from the soil. Plants use all the material to make sugars, chlorophyll etc. Plants have different channels for the distribution of water, minerals and sugars.

Q2. Explain the Internal Structure of a dicot Root. Draw and label transverse section of dicot Root.

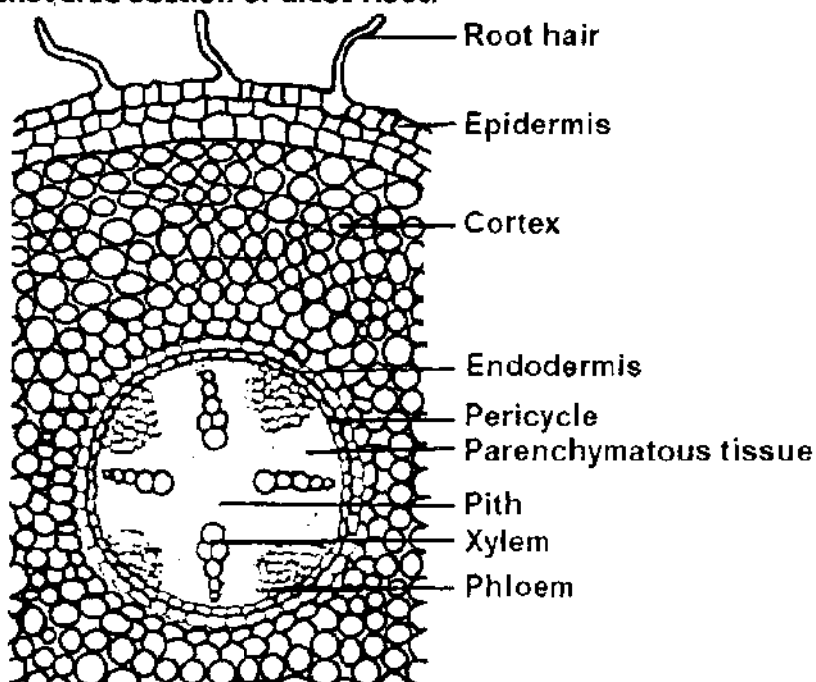
Ans: A thin transverse section of dicot root shows the following internal structure under microscope.

Epidermis is a single outermost layer of thin-walled cells having root hairs.

Cortex consists of many layers of parenchyma cells. Inner to the cortex is the endodermis. Pericycle is a single ring like layer internal to the endodermis.

Vascular Bundles consist of xylem and phloem. Bundles of phloem tissue alternate with bundles of xylem tissue. Pith is a small area in the centre.

transverse section of dicot Root:



T.S. of dicot root

BIOLOGY NOTES FOR 9TH CLASS

Q3. Describe the Structure of Root Hair?

Ans: Root hairs are projection of epidermal cells. Root hair are long and narrow. The root hair greatly increases the surface area of roots for absorption of water and minerals.

Q4. Define transpiration and relate it with cell surface and with stomatal opening and closing.

Ans: Transpiration:

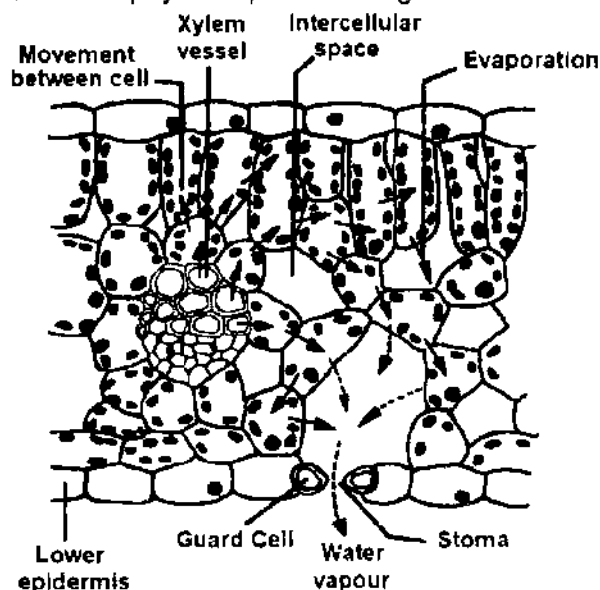
A plant uses only little amount of water to perform its life processes. The excess of water has to be removed mainly by evaporation. The loss of water as vapours from the aerial parts of the plants is known as transpiration.

Transpiration and Surface Area:

The cell wall soaks up water like blotting paper and water evaporates from the cell walls. The total surface area of all the cell walls is very large, so a lot of water can quickly evaporate and become water vapour inside the air spaces of mesophyll.

Transpiration and Stomata:

The tiny pores on the leaf surface are called stomata, which is surrounded by two guard cells. The inner wall of each guard cell is thick and elastic. The outer wall is much thinner. The guard cell is surrounded by epidermal cell. The water vapours escape out of mesophyll air spaces through stomata.



Movement of water through a leaf

Transpiration and Wilting:

During hot sunny days transpiration speeds up. Excessive transpiration causes cells to lose their water content and become flaccid. The flaccid cells give no support to the plant and wilting occurs so that the leaves, flowers and other non-woody tissue droop.

Due to wilting the guard cells become flaccid and the stomata close and the rate of transpiration is reduced. The rate of photosynthesis is reduced, because amount of carbon dioxide is reduced as the stomata are closed.

BIOLOGY NOTES FOR 9TH CLASS

Q5. What do you know about transport system in man?

Ans: A specialized system has evolved in complex animals to distribute materials to all parts of the body. In mammals including man, the transport system consists of blood circulatory system, which contains the fluid called blood, pump called heart and pipes called blood vessels.

Q6. Write a note on Blood Transfusion.

Ans: If a person with blood A gives blood to a person with type B there will be clumping of blood due to presence of anti A antibody in the blood group B and the recipient will probably die.

A person with blood group AB has neither anti A nor anti B antibody and can safely receive A, B or O blood group.

A person with blood group O has no cell antigen and can safely give blood to any other type

Universal donor:

The person with blood group "O" is therefore known as universal donor.

Universal recipients:

The person with blood group AB is considered to be universal recipients.

Q7. Briefly describe Rh Blood Group.

Ans: Rh Blood Group:

Rh blood group is due to antigen, called Rh factor, named after Rhesus monkey. If Rh factor is present on the red blood cell membrane the blood is said to be Rh positive and if the red blood cells lack Rh factor, the blood is called Rh negative.

Q8. How Disorders of Blood can be prevented?

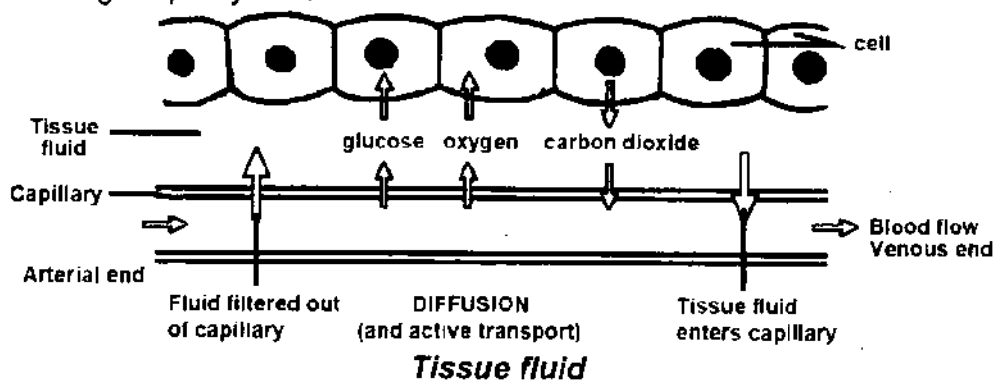
Ans: Prevention:

We know that prevention is better than cure. Genetic counselling can help to reduce the chances of disease. Marriage between thalassemia minor persons should be avoided.

Q9. What is Tissue Fluid and how it is flow in capillaries.

Ans: In the tissue some fluid oozes out of the capillaries and fills the intercellular spaces. This colourless fluid is called tissue fluid.

Small gaps are present in the walls of the capillaries. These gaps allow movement of small molecules and ions. Blood cells and plasma proteins cannot pass-through capillary walls.



BIOLOGY NOTES FOR 9TH CLASS

Q10. Compare the structure and function of an artery, a vein and a capillary.

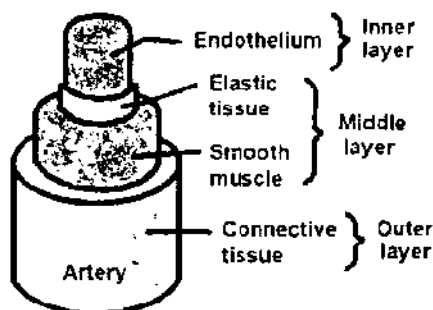
Ans: Blood Vessels:

Blood moves through a system of three types of vessels, the arteries, veins and capillaries.

i. Arteries:

Arteries carry blood away from the heart. Artery consists of three layers. Endothelium is the inner most layer. The middle layer consists of smooth muscle and elastic fibres or tissue. The outer most layer consists mainly of the connective tissues.

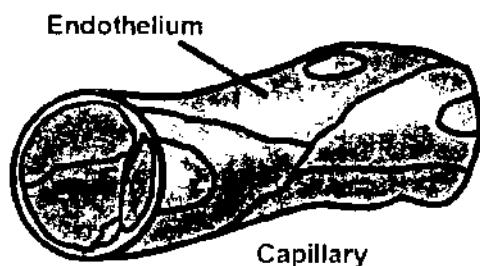
Arterioles are the smallest arteries which transport blood. The arteries undergo elastic recoil and contract, to produce thumping vibrations called pulse.



ii. Capillaries:

Capillaries form a vast network of vessels in all parts of the body. The walls of capillaries are very thin, consisting of only a single layer of cells, the endothelium.

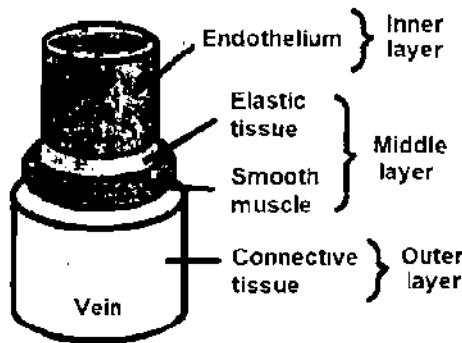
The lumen of the capillaries is very narrow, so the RBCs can move through them only in a single row. In the capillaries the exchange of materials takes place by diffusion.



iii. Veins:

The blood vessels that bring blood back to the heart are called veins. A vein consists of three layers, i.e., inner layer, middle layer and out layer, the walls of the inner layer are thin and almost inelastic.

The lumen of the vein is large. Semilunar valves are present.



BIOLOGY NOTES FOR 9TH CLASS

SUMMARY

1. Water and dissolved minerals move upward in xylem from roots to stem and leaves.
2. Water moves from an area of higher water concentration to an area of lower water concentration.
3. Transpiration pull causes tension at the top of the plant. As a result, water moves from the soil to root xylem to stem xylem, to leave xylem to the atmosphere.
4. Dissolved sugar is translocated upward or downward in phloem. Sucrose is a predominant sugar translocated in phloem. As a result, water moves into these sieve tubes by osmosis. Sugar is actively unloaded from the sieve tubes at the sink. As a result, water leave the sieve tube.
5. Human blood consists of liquid plasma in which red blood cells, white blood cells and platelets are suspended.
6. Red blood cells transport oxygen and small amount of carbon dioxide.
7. White blood cells defend the body against diseases. Lymphocytes and monocytes are agranular white blood cells while neutrophils, eosinophils and basophils are granular white blood cells.
8. Platelets patch damaged blood vessels and release substances essential for blood clotting.
9. Arteries carry blood away from the heart chambers; veins return blood to the heart chambers.
10. Capillaries are the thin-walled vessels through which materials pass back and forth between the blood and tissues.
11. The human heart consists of two atria, which receive blood from veins and two ventricles, which pump blood into the arteries.
12. The heart is enclosed by pericardium and has valves that prevent backflow of blood.
13. The pulmonary circulation connects heart and lungs. The systemic circulation connects the heart with the other body organs.
14. In pulmonary circulation, the right ventricle pumps blood into pulmonary arteries, one is going to each lung. Blood circulates through pulmonary capillaries in the lungs and is then conducted to the left atrium by a pulmonary vein.
15. In the systemic circulation, the left ventricle pumps blood into the aorta, which branches into arteries leading to the body organs. After flowing through the capillary networks within various organs, blood flows into vein that conducts it to the right atrium.
16. The coronary circulation supplies blood to the heart muscles.
17. The hepatic portal system carries nutrient-rich blood from intestine to the liver.
18. The disorder of the heart and blood vessels is called cardiovascular disorder e.g., atherosclerosis, arteriosclerosis and myocardial infarction

BIOLOGY NOTES FOR 9TH CLASS

EXERCISE

(MCQs)

● **Select the correct answer:**

1. **Food is transported in plants in the form of:**
A. proteins B. glucose
C. starch D. lipids
2. **Stomata close when guard cells:**
A. lose water B. gains chloride ions
C. become turgid D. gain potassium ions
3. **The principle tissue for transpiration is:**
A. cortex B. spongy mesophyll
C. epidermis C. xylem
4. **The large number of stomata are present on:**
A. upper epidermis B. lower epidermis
C. root epidermis D. stem epidermis
5. **Guard cells differ from epidermal cells in having:**
A. mitochondria B. vacuoles
C. cell wall D. chloroplasts
6. **Which of the following is not a leukocyte?**
A. Lymphocyte B. Monocyte
C. Eosinophil D. Thrombocyte
7. **The normal pH of human blood is:**
A. 7.1 B. 7.2 C. 7.3 D. 7.4
8. **The source of sugars and other organic solutes in sap is:**
A. root B. photosynthesising cell
C. xylem D. phloem
9. **The left half of the human heart:**
A. is responsible for systemic circulation
B. is responsible for pulmonary circulation
C. circulates blood to the lungs.
D. passes blood through the right ventricle
10. **The pulmonary arteries carry blood to the:**
A. brain B. heart
C. liver D. lungs

ANSWERS:

1. B	2. A	3. C	4. B	5. D
6. D	7. D	8. D	9. C	10. D

BIOLOGY NOTES FOR 9TH CLASS

SHORT QUESTIONS

- Q1. Write the function of: xylem, phloem, root hairs, palisade cells, stomata, epidermis, pericardium, left atrium, left ventricle, right atrium, right ventricle, tricuspid valve, bicuspid valve, semilunar valve, septum, aorta, pulmonary artery, pulmonary vein, guard cells, stomata, mesophyll cells, plasma, red blood cells, white blood cells, platelets.**

Ans:

Terms	Function
Xylem	Water and dissolved minerals move upward in xylem from roots to stem and leaves.
Phloem	Cells, which transfer food materials synthesized by the leaf to other parts of the plant.
Root hairs	Root hairs are projection of epidermal cells. Root hair are long and narrow. The root hair greatly increases the surface area of roots for absorption of water and minerals.
Palisade cells	Their function is to enable photosynthesis to be carried out efficiently and they have several adaptations.
Stomata	The stomata are primarily meant for absorption of carbon dioxide, but at the same time water vapours also escape through stomata.
Epidermis	The primary function of the epidermis is to protect your body by keeping things that might be harmful out and keeping the things your body needs to function properly in.
Pericardium	The heart is enclosed by pericardium and has valves that prevent backflow of blood.
Left atrium	When the left atrium contracts the blood enters the left ventricle through bicuspid valve.
Left ventricle	it has to pump the blood further around the body, and against higher pressure, compared with the right ventricle.
Right atrium	Blood from lower parts of the body is brought back by the inferior vena cava to the right atrium. Thus, the right atrium receives deoxygenated blood from the two-vena cava. When the right atrium contracts, the blood flows into the right ventricle through the tricuspid valve.
Right ventricle	When the right ventricle contracts the blood pressure closes tricuspid valve. This prevents back flow of blood into the atrium.
Tricuspid valve	The opening between right atrium and right ventricle is guarded by a valve known as tricuspid valve (because it has 3 flaps).

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Bicuspid valve	Bicuspid valve prevents the backflow of blood from left ventricle to left atrium. At the base of aorta, aortic semilunar valve is present which prevents the backflow of blood from aorta to left ventricle.
Semilunar valve	Semilunar valve is present which prevents the backflow of blood from pulmonary trunk to right ventricle.
Septum	The septum separates the atria and ventricles in such a way that it forms a barrier between the heart chambers and this prevents mixing of oxygenated and deoxygenated blood.
Aorta	Aorta also has semilunar valves to prevent back flow into the left ventricle. The main artery that carries oxygenated blood from left ventricle.
Pulmonary artery	The pulmonary artery carries deoxygenated blood from the right ventricle to the lungs.
Pulmonary vein	It transfer freshly oxygenated blood from the lungs to the left atria of the heart.
Guard cells	Guard cells are cells surrounding each stoma. They help to regulate the rate of transpiration by opening and closing the stomata.
Stomata (singular 'stoma')	Tiny pores in the epidermis of a leaf. They control water loss and gas exchange by opening and closing.
Mesophyll cells	The most important role of the mesophyll cells is in photosynthesis. Mesophyll cells are large spaces within the leaf that allow carbon dioxide to move freely.
Plasma	Plasma function is to produce antibody.
Red blood cells	RBC have iron-containing pigment haemoglobin in its cytoplasm, which gives red colour to the blood. RBC's are formed in bone marrow after birth. RBCs carry oxygen and also transport a small amount of carbon dioxide.
White blood cells	WBC's defends the body against infection and disease by ingesting foreign materials and cellular debris
Platelets	White blood cell fragments which circulate in the blood and assist in clotting.

- Q2. Differentiate between:**
- Evaporation and transpiration**
 - Serum and blood**
 - Artery and vein**
 - Tricuspid and bicuspid valve**
 - Systole and diastole**
 - Sink and source**

BIOLOGY NOTES FOR 9TH CLASS

- g. Xylem and phloem
- h. Pith and cortex
- i. Cohesion and adhesion
- j. Antigen and antibodies
- k. Guard cells and epidermal cells
- l. Pulmonary artery and pulmonary vein
- m. Red blood cells and white blood cells

Ans: (a) Evaporation and transpiration:

Evaporation	Transpiration
Evaporation is the process of the release of water into the air from open water surfaces.	The loss of water as vapours from the aerial parts of the plants is known as transpiration.
The evaporation of water from the leaves results in a suction force which pulls the water up the xylem vessels.	Transpiration results in the transport of water and minerals from the soil to the leaves, where they form raw material of photosynthesis.
Evaporation occurs when energy in the form of heat is applied to water and changes it into water vapor.	Transpiration naturally occurs in plants. Transpiration depends on the moisture content of the soil on which the plant is planted and the humidity of the air.

(b) Serum and blood:

Serum	Blood
Serum is the liquid part of the blood after the coagulation.	A fluid circulating connective tissue that transports nutrients and other materials through the body of many types of animals.
Serum contain antibodies and cross react with recipient antigen.	Blood Contain plasma, blood cell and cell like bodies.

(c) Artery and vein:

Artery	Vein
The arteries are the blood vessels that deliver oxygen-rich blood from the heart to the tissues of the body.	Veins are a type of blood vessel that return deoxygenated blood from your organs back to your heart.
Arteries carry blood away from the heart to the tissues of the body.	Veins carry blood from the tissues of the body back to the heart.
Arteries carry oxygenated blood except pulmonary artery.	Veins carry deoxygenated blood except pulmonary vein.
Arteries have thick elastic muscular walls.	Veins have thin non elastic less muscular walls.
Valves are absent.	Valves are present.
Arteries possess narrow lumen.	Veins possess wide lumen.

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Blood flows under high pressure.	Blood flows under low pressure.
Arteries are reddish in colour.	Veins are bluish in colour.

(d) Tricuspid and bicuspid valve:

Tricuspid valve	Bicuspid valve
Tricuspid valve is one of the four valves of the heart which is situated between the right atrium and the right ventricle.	Bicuspid valve is one of the four valves of the heart which is situated between the left atrium and the left ventricle.
Tricuspid valve is present in between the right atrium and the right ventricle.	Bicuspid valve is present in between the left atrium and the left ventricle.
Tricuspid valve permits blood flow from the right atrium into the right ventricle and prevents backflow.	Bicuspid valve permits blood flow from the left atrium into the left ventricle and prevents backflow.
Tricuspid valve possesses three cusps.	Bicuspid valve possesses two cusps.

(e) Systole and diastole:

Systole	Diastole
The period of contraction is called systole	The period of relaxation is called diastole.
A heartbeat includes one systole.	A heartbeat includes one diastole.
The systolic pressure undergoes considerable fluctuations at different conditions like the extent of work done by heart, the force at which the heart is working, etc.	The diastolic pressure undergoes much less fluctuation in health and remains within a limited range. The increase in diastolic pressure indicates that the heart is approaching towards failure.

(f) Sink and source:

Sink	Source
Sink is the plant sites which store the produced food.	Source is the plant sites where production of food takes place.
The main function of sink is to store the produced food in plants for further metabolic activities of the plant.	The main function of source is to produce food in plants or act as entry points for nutrient uptake.
Phloem unloading takes place at the sink.	Phloem loading takes place at the source.
Rate of photosynthesis is low or zero.	Rate of photosynthesis is high.
Example: Stems, roots and flowers.	Example: Leaves, fruits.

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(g) Xylem and phloem:

Xylem	Phloem
Xylem tissue is responsible for the transport of water and dissolved substances from roots to the aerial parts.	Phloem tissue is responsible for the conduction of dissolved organic matter (food) between different parts of the plant body.
It consists of two types of cells i.e. vessel elements and tracheids.	It consists of sieve tube cells and companion cells.
It is located in the centre of the vascular bundle.	It is located on the outer side of the vascular bundle.
They live with hollow dead cells.	They live with cytoplasm without the nucleus.
Forms vascular bundles with phloem.	Forms vascular bundles with xylem

(h) Pith and Cortex:

Pith	Cortex
In botany, a pith refers to the soft central cylinder of parenchymatous tissue in the stem of the plant.	Cortex, in plants, tissue of unspecialized cells lying between the epidermis (surface cells) and the vascular, or conducting, tissues of stems and roots.
The ground tissue towards the interior of the vascular tissue in a stem or root is known as pith.	The cortex is bounded on the outside by a single layer of epidermal cells.
Pith is a small area in the centre.	Cortex consists of many layers of parenchyma cells.

(i) Cohesion and Adhesion:

Cohesion	Adhesion
Cohesion is the clinging together of the same kind of molecules	Adhesion is the attraction of different molecules.
A strong adhesion force causes the liquid to spread all over the surface.	A strong force of cohesion forms water droplets on any surface.
Cohesion is caused by hydrogen bonding and Van der Waal forces.	Adhesion is caused by electrostatic or mechanical forces that exist among two kinds of different substances.

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(j) Antigen and antibodies:

Antigen	Antibodies
Antigen is a molecule that can stimulate an immune response in the body.	An antibody, also known as an immunoglobulin, is a Y-shaped protein secreted by certain types of white blood cells which have the ability to identify pathogens (infective agents) such as viruses and bacteria.
Antigens are usually lipids. However, they can also be proteins, carbohydrates and nucleic acids.	All antibodies are proteins.
Antigens cause allergic reactions or even illnesses.	Protects against the effects of the antigen either by lysis or immobilization of the particle.
Usually from a foreign substance (viruses, and bacterial and fungal toxins).	Naturally produced by the body (B lymphocytes or B cells).

(k) Guard cells and epidermal cells:

Guard cells	Epidermal cells
Guard cells are specialized cells found in the epidermis of leaves and stems of plants.	Epidermal cells are the cells found in the outermost layer of plants.
They perform the gas exchange of plants with the external environment, forming a stoma.	Epidermal cells are irregular in shape and tightly bound to each other in order to provide the mechanical support to the plant.
The guard cells are bean-shaped in surface view.	Epidermal cells are irregular in shape.
The guard cells contain chloroplasts, so they can manufacture food by photosynthesis.	The epidermal cells do not contain chloroplasts.

(l) Pulmonary artery and Pulmonary vein:

Pulmonary artery	Pulmonary vein
The pulmonary artery carries deoxygenated blood from the right ventricle to the lungs.	The veins from lungs, called pulmonary veins return the oxygenated blood to the left atrium of the heart.
Carries blood from the left ventricle of the heart to lungs.	Carries blood from the lungs to right atrium of the heart.
Divides into two: each artery carries blood to each of the lungs.	Divides into four: each pair of veins goes to each lung.
Wall is thick and elastic.	Wall is comparatively thin.

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(m) Red blood cells and White blood cells:

Red blood cells	White blood cells
Red blood cells are called erythrocytes.	White blood cells are called leukocytes.
R.B.C is a circular flattened, biconcave disc.	Each white blood cell is irregular in shape and contains a nucleus.
Their life span is 120 days.	Their life span is 3-4 days.
RBCs carry oxygen and also transport a small amount of carbon dioxide	WBCs function as the main agents in body's defence system.

Q3. How does water enter a plant?

Ans: Water enters the plant via the roots. Water enters the root by osmosis and moves along through the root cells in the same way until it gets to the xylem vessels. These vessels carry water up the stem to the leaf. Water is lost from the leaves of plants by evaporation.

Q4. How do guard cells control opening and closing of stomata?

Ans: Opening and Closing of Stomata:

The opening and closing of stomatal pores is regulated by guard cells by increasing or decreasing the amount of water in them. When water enters the guard cells, they become turgid. This results in opening of stomata pore. When water exits from the guard cells, they become flaccid. This results in closing of stomata.

Guard cells use osmotic pressure to open and close stomata, allowing plants to regulate the amount of water and solutes within them.

In order for plants to produce energy and maintain cellular function, their cells undergo the highly intricate process of photosynthesis. Critical in this process is the stoma.

OR

(Second Answer)

Opening and Closing of Stomata:

There are two hypotheses which may explain the opening and closing of stomata.

Starch Sugar Hypothesis:

In the presence of light energy guard cells perform photosynthesis and produce sugar. As sugar concentration increases in the guard cell, water enters the guard cell. The guard cells become turgid. The thin outer walls bulge out and force the inner wall into a crescent shape. In this way a pore is formed between each pair of guard cells thus opening stomata. In the dark most of the sugar molecules are used by respiration or are converted into insoluble starch. As sugar concentration decreases water molecules diffuse out of the epidermal cells. When the guard cell loses water, it becomes flaccid. The inner thick walls move together until the pore between them is closed. Closing of stomata completely stops transpiration.

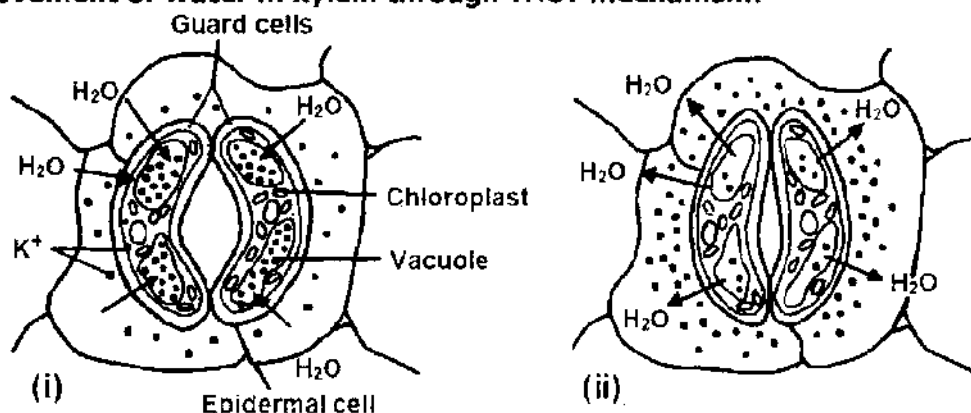
Influx of Potassium Ions Hypothesis:

Day light stimulates potassium ions to enter guard cells from the surrounding epidermal cells by active transport. The accumulation of potassium ion increases

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concentration of the guard cells cytoplasm. Water (shown in blue arrows) enters the guard cells by osmosis. The guard cells become turgid and are stretched and stomata are opened, in the darkness potassium ions move out of the guard cells in the surrounding epidermal cells. The water of the guard cells follows potassium and moves out of the cells. The loss of water changes their shape again and stoma closes.

Movement of water in xylem through TACT mechanism:



Movement of water in xylem through TACT mechanism

Q5. How do rise in temperature and wind velocity affect transpiration?

Ans: Temperature affecting transpiration:

The temperature warms the water inside leaves making it evaporate more quickly. An increase in temperature doubles the rate of transpiration, for every temperature rise of about 10°C.

If temperature exceeds 30°C to 45°C the stomata become closed.

Wind velocity affecting transpiration:

In still air, the region round a transpiring leaf will become saturated with water vapour so that no more water can escape from the leaf. In these conditions, transpiration would slow down.

In moving air, the water vapour will be moved away from the leaf as fast as it diffuses out. This will speed up transpiration.

Q6. Why a person having blood group "O" is called "universal donor" and "AB" a universal recipient?

Ans: Universal donors:

O blood group individuals are called universal donors, because they can donate blood to the recipients of every other blood group.

Universal recipients:

AB blood group individuals are called universal recipients, because they can receive transfusions from the donors of every other blood group.

Q7. How are the valves of human heart important?

Ans: The valves prevent the backward flow of blood. These valves are actual flaps that are located on each end of the two ventricles (lower chambers of the heart). They act as one-way inlets of blood on one side of a ventricle and one-way outlets of blood on the other side of a ventricle.

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These are one-way valves that prevent blood from flowing through the heart in the reverse direction when the heart is at rest.

The valves in the heart allows the flow of blood only in one direction from atria to the ventricles from the ventricles to the pulmonary aorta. These valves prevent any backward flow.

Q8. What are the types of white blood cells?

Ans: White Blood Cells:

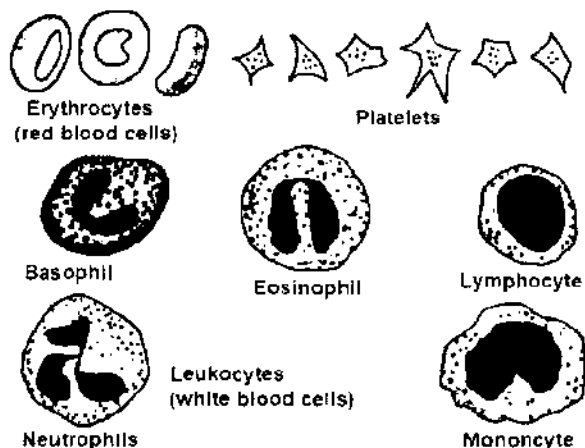
White blood cells are called leukocytes. Their life span is 3-4 days. Each white blood cell is irregular in shape and contains a nucleus.

Types / Classification of White Blood Cells:

WBC's can be divided into two main types:

- i. Granular leukocytes
 - ii. Agranular leukocytes
- i. **Granular Leukocytes:** Their nucleus is variable in shape. Cytoplasm contains fine granules. These originate in bone marrow. Granular leukocytes are of three types, neutrophils, eosinophils and basophils.
 - **Neutrophils:** Neutrophils engulf pathogens during phagocytosis.
 - **Eosinophils:** Eosinophils are involved in the control of allergic reactions.
 - **Basophils:** Basophils release histamine in injured tissue and in allergic response.
 - ii. **Agranular Leukocytes:** The cytoplasm is clear. These are of two types i.e., monocytes and lymphocytes.
 - **Monocytes:** These are phagocytic and ingest bacteria and dead cells at the damaged tissue region
 - **Lymphocytes:** There are two types of lymphocytes. B Lymphocytes protect us by producing antibodies. T lymphocytes directly destroy any cell that bears antigens.

Blood cells:



Blood cells

Q9. What would happen if a person with type B positive blood receives a transfusion of A positive blood?

Ans: People with type A blood create antibodies against B antigens. A person with type A blood receiving a transfusion of type B or AB blood would have an ABO

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incompatibility reaction. In an ABO incompatibility reaction, your immune system attacks the new blood cells and destroys them.

Q10. What would happen if a person with Rh-positive blood receives a transfusion of Rh-negative blood?

Ans: Antibody against Rh Antigen:

Normally no one has Anti Rh antibody in the plasma. If the Rh-negative person is given Rh-positive blood, it will stimulate the plasma to produce antibody. If the same Rh-negative person is given Rh positive blood, the antibody already formed in the plasma against Rh positive will react with donated blood. The person can even die.

Q11. Write the contributions of Ibn-al-Nafis and William Harvey.

Ans: Contributions of Ibn-al-Nafis:

Ibn-al-Nafis was the first person to describe the circulation of blood. He discovered blood pulmonary circulation.

Contributions of William Harvey:

William Harvey described the pathway of blood circulation in the body.

Q12. In what way does pulmonary artery differ from all other arteries in the body?

Ans: Arteries carry oxygenated blood away from the heart to all parts of the body. The left ventricle pumps oxygenated blood out of the heart into the aorta the largest artery, which is responsible for carrying blood to all parts of the body in order to receive oxygen.

Pulmonary artery carries deoxygenated blood away from the right side of the heart to the lungs. This blood is high in carbon dioxide and must be transported to the lungs in order to become oxygenated.

Q13. Name the blood vessels that supply blood to:

- | | | |
|--------------|----------|-----------|
| a. head | b. liver | c. kidney |
| d. hind limb | e. heart | |

Ans: Blood vessels that supply blood to:

a. head:

Carotid arteries supply blood to the head and neck.

b. liver:

Hepatic artery supplies blood to the liver.

c. kidney:

Renal arteries supply blood one to each kidney.

d. hind limb:

The external iliac artery is the principal artery of the hind limb.

e. heart:

Coronary arteries supply blood to the heart itself.

Q14. Suggest why an injury that cuts open an artery is much more dangerous than an injury to vein.

Ans: When an artery is damaged, it can bleed quickly and can become life-threatening. Veins can also get hurt in an accident. Veins carry blood from the body back to the heart. Bleeding from veins is slower and stops more easily, so it is usually less dangerous.

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Q15. Why are valves present in veins but not arteries?

Ans: Unlike arteries, veins contain valves that ensure blood flows in only one direction. Arteries don't require valves because pressure from the heart is so strong that blood is only able to flow in one direction. Valves also help blood travel back to the heart against the force of gravity.

Q16. Why are the walls of the atria thinner than the walls of the ventricle?

Ans: The atria are thinner than walls of ventricle because of their function. This blood is pumped down to the ventricles, which are larger pumping chambers which must propel blood out of the heart. Therefore, they contain more muscle tissue than the atria do.

Q17. Why is the muscle of the left ventricle thicker than that of the right ventricle?

Ans: The left ventricle of your heart is larger and thicker than the right ventricle. This is because it has to pump the blood further around the body, and against higher pressure, compared with the right ventricle.

EXTENSIVE QUESTIONS

Q1. What are guard cells? How do they regulate transpiration?

Ans: Guard cells:

It is the responsibility of stomata to regulate transpiration via the actions of guard cells.

Functions of guard cells:

The two guard cells of a stoma are attached to each other at their ends. The inner concave sides of guard cells that enclose a stoma are thicker than the outer convex sides.

When guard cells get water and become turgid, their shapes are like two beans and the stoma between them opens. When guard cells lose water and become flaccid, their inner sides touch each other and stoma closes.

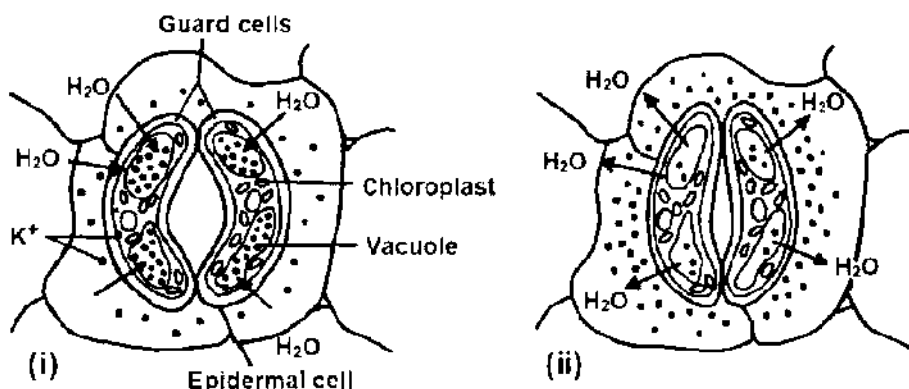
Guard cells are the kidney shaped cells that surround the stomata and are responsible for opening and closing of the stomatal pore.

When potassium ions accumulate in the guard cells, they absorb water and become swollen or turgid. **Due to their turgidity the stomatal pore opens up completely and transpiration occurs.** When they lose water due to external influences like sunlight, temperature, etc, they become flaccid and close the stomatal opening and hence stop the transpiration.

Guard cells are cells surrounding each stoma. They help to regulate the rate of transpiration by opening and closing the stomata. Light is the main trigger for the opening or closing. Each guard cell has a relatively thick cuticle on the pore-side and a thin one opposite it.

Note: The concentration of solutes (glucose) in guard cells is responsible for the opening and closing of stomata

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Q2. Why transpiration is considered as necessary evil?

Ans: Transpiration is a Necessary Evil:

The stomata are primarily meant for absorption of carbon dioxide, but at the same time water vapours also escape through stomata. Thus, transpiration is a necessary evil because it is necessary but may become harmful. Loss of water can lead to wilting, serious drying up and often death of a plant, if there is shortage of water.

Transpiration is called a necessary evil. It means that transpiration is a potentially harmful process but is unavoidable too.

Significance of Transpiration:

- i. Transpiration is called a necessary evil. It means that transpiration is a potentially harmful process but is unavoidable too.
Transpiration may be a harmful process in the sense that during the conditions of drought, loss of water from plant results in serious desiccation, wilting and often death.
- ii. On the other hand, transpiration is necessary too. It creates a pulling force called **transpirational pull** which is principally responsible for the conduction of water and salts from roots to the aerial parts of plant body.
- iii. When water transpires from the surfaces of plant, it leaves a cooling effect on plant. This is especially important in warmer environments. Moreover, the wet surfaces of leaf cells allow gaseous exchange.

Note: There is strong evidence that even mild water stress results in reduced growth rate.

Q3. Describe the process of uptake of water and minerals by plants.

Ans: Uptake of water and Mineral Salts by Plants:

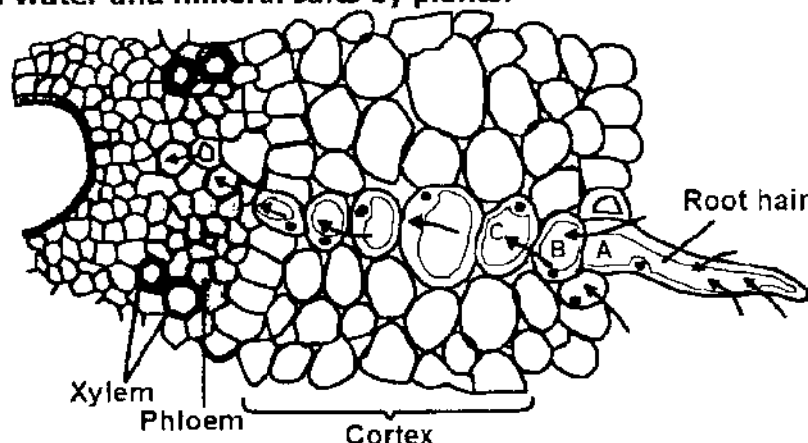
Water and mineral salts first enter through the cell wall and cell membrane of the root hair cell by osmosis.

Absorption of water and mineral salts takes place mainly through root hair. The cell sap is more concentrated than the soil solution. This results in water entering the root hair by osmosis.

Water moves from cell to cell by osmosis and finally enters the xylem vessels and moves up the plant. Mostly mineral salts pass through by simple diffusion into the root hair and then through the cortex into the xylem vessels. However, when there is deficiency of minerals in the soil, the absorption of mineral salts by the root hair is done by active transport.

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Uptake of water and mineral salts by plants:



Uptake of water and mineral salts by plants

Q4. Describe the structure, and mechanism of opening and closing of stomata. Name the activities which take place in stoma during day and night.

Ans: Opening and Closing of Stomata:

The opening and closing of stomata is governed by increases or decreases of solutes in the guard cells, which cause them to take up or lose water, respectively. In general, stomata open by day and close at night. During the day, stomata close if the leaves experience a lack of water, such as during a drought.

Mechanism of the closing and opening of the stomata:

- The mechanism of the closing and opening of the stomata depends upon the presence of sugar and starch present in the guard cells.
- In the presence of light, the guard cells of the stomata contain sugar which is synthesized by their chloroplasts.
- The sugar is soluble and increases the concentration of guard cells.
- Due to higher concentration of the cytoplasm of guard cells, the water enters into these cells from the neighbouring cells by osmosis. Hence, the stomata remains open.

In the absence of light the sugar present in guard cells converts into the starch. The starch is insoluble, and this way the guard cells remains in lower concentration than the of neighbouring cells, and the neighbouring cells take out the water from the guard cells by osmosis making them flaccid and the stomata closed.

Hypotheses which may explain the opening and closing of stomata:

There are two hypotheses which may explain the opening and closing of stomata.

Starch Sugar Hypothesis:

In the presence of light energy guard cells perform photosynthesis and produce sugar. As sugar concentration increases in the guard cell, water enters the guard cell. The guard cells become turgid. The thin outer walls bulge out and force the inner wall into a crescent shape.

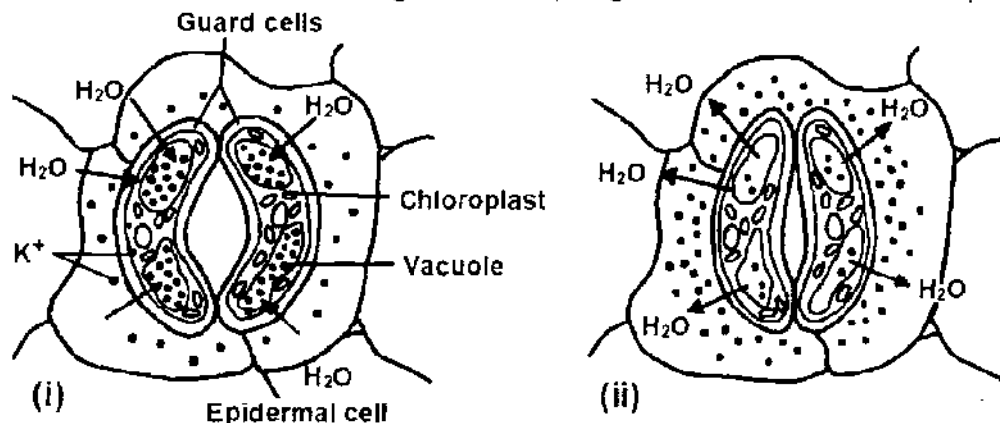
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In this way a pore is formed between each pair of guard cells thus opening stomata. In the dark most of the sugar molecules are used by respiration or are converted into insoluble starch. As sugar concentration decreases water molecules diffuse out of the epidermal cells. When the guard cell loses water, it becomes flaccid. The inner thick walls move together until the pore between them is closed. Closing of stomata completely stops transpiration.

Influx of Potassium Ions Hypothesis:

Day light stimulates potassium ions to enter guard cells from the surrounding epidermal cells by active transport. The accumulation of potassium ion increases concentration of the guard cells cytoplasm. Water (shown in blue arrows) enters the guard cells by osmosis.

The guard cells become turgid and are stretched and stomata are opened, in the darkness potassium ions move out of the guard cells in the surrounding epidermal cells. The water of the guard cells follows potassium and moves out of the cells. The loss of water changes their shape again and stoma closes.



Movement of water in xylem through TACT mechanism

Q5. Describe movement of water from roots to leaves.

Ans: Transport of Water:

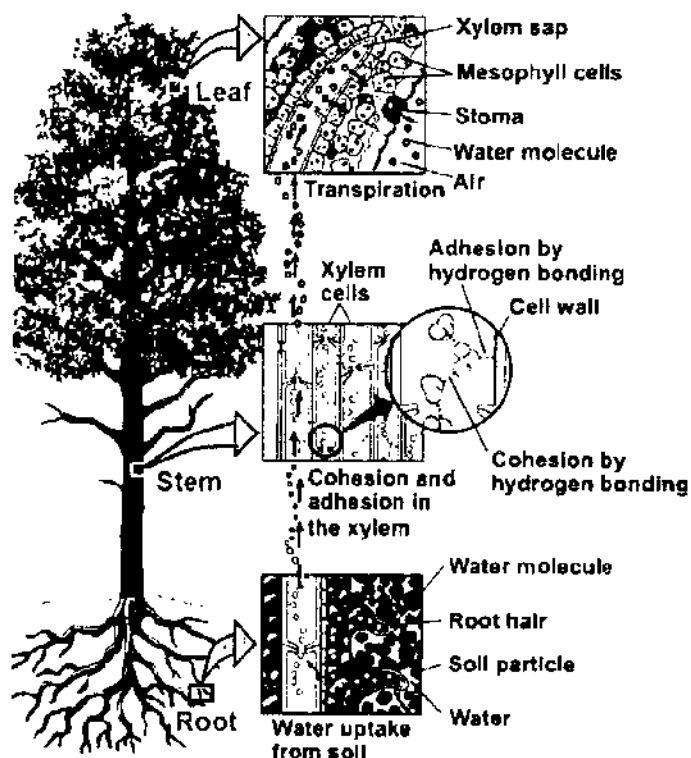
Water is transported through the xylem 'pipeline' from roots to leaves. Two properties of water make this possible, cohesion and adhesion.

Cohesion is the clinging together of the same kind of molecules. **Adhesion** is the attraction of different molecules.

Water molecules cling to one another and adhere to the walls of xylem vessels and tracheids. In the narrow tubes of vessels and tracheids, the combination of cohesion and adhesion form a continuous column of water from roots up to the leaves.

The evaporation of water from the leaves results in a suction force which pulls the water up the xylem vessels. This suction force due to transpiration is called transpiration pull.

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Q6. Explain the factors affecting rate of transpiration?

Ans: Factors Affecting the Rate of Transpiration:

Any change, which increases or reduces evaporation, will have the same effect on transpiration.

Temperature:

The temperature warms the water inside leaves making it evaporate more quickly. An increase in temperature doubles the rate of transpiration, for every temperature rise of about 10°C. If temperature exceeds 30°C to 45°C the stomata become closed.

Wind:

In still air, the region round a transpiring leaf will become saturated with water vapour so that no more water can escape from the leaf. In these conditions, transpiration would slow down. In moving air, the water vapour will be moved away from the leaf as fast as it diffuses out. This will speed up transpiration.

Humidity:

If the air is very humid i.e., contains lot of water vapour, it can accept very little water vapour from the plants and so transpiration slows down. In dry air rate of transpiration will be rapid.

Q7. What is the importance of transpiration?

Ans: A plant uses only little amount of water to perform its life processes. The excess of water has to be removed mainly by evaporation. The loss of water as vapours from the aerial parts of the plants is known as transpiration.

Importance of Transpiration:

Transpiration is of great importance to the plants.

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- i. Transpiration results in the transport of water and minerals from the soil to the leaves, where they form raw material of photosynthesis.
- ii. Evaporation of water has a cooling effect on plant.

Significance of Transpiration:

- i. Transpiration is called a necessary evil. It means that transpiration is a potentially harmful process but is unavoidable too. Transpiration may be a harmful process in the sense that during the conditions of drought, loss of water from plant results in serious desiccation, wilting and often death.
- ii. On the other hand, transpiration is necessary too. It creates a pulling force called **transpirational pull** which is principally responsible for the conduction of water and salts from roots to the aerial parts of plant body.
- iii. When water transpires from the surfaces of plant, it leaves a cooling effect on plant. This is especially important in warmer environments. Moreover, the wet surfaces of leaf cells allow gaseous exchange.

Note: There is strong evidence that even mild water stress results in reduced growth rate.

Q8. Define translocation? Describe pressure flow mechanism of translocation in plants.

Ans: Translocation:

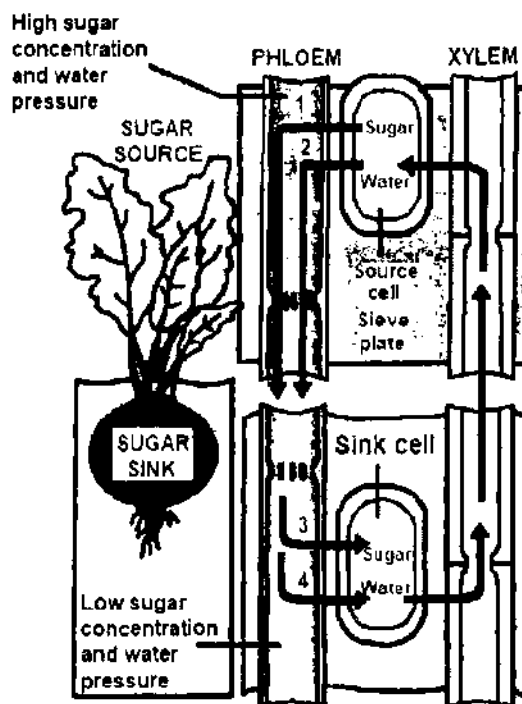
The process of movement of food from leaf to different parts of the plant is known as **translocation**

The process of photosynthesis takes place in the leaves, during which glucose is made. Glucose is converted into other soluble products, which are sugar, amino acids and fatty acids. These are carried in solution to all parts of the plants by phloem.

Pressure Flow Mechanism:

The most widely accepted hypothesis, explaining phloem transport is called pressure flow hypothesis. A location in a plant where sugar is being produced either by photosynthesis or by the breakdown of stored starch is called a sugar source e.g., green leaves and stem. A location in a plant where sugar is consumed or stored is called a sugar sink, e.g., young leaves, fruits etc.

According to pressure flow hypothesis water containing sugar in solution flows under pressure through the phloem. At source, sucrose is loaded into sieve tubes by using energy from ATP. So, the concentration of sugar increases in the phloem cells. Water enters the phloem cells from the surrounding xylem cells. The



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turgor pressure increases in phloem cells. It forces the sap through the phloem sieve tube to sink. Sugar is removed by the sink and is consumed or converted into starch. Thus, the concentration of the contents of phloem decreases. Remaining water enters xylem vessels.

Q9. Write in detail the structure and functions of components of blood?

Ans: Blood:

Blood is a type of special connective tissue with cells suspended in a fluid medium. The blood circulates in the blood vessels. Almost all the substances to be transported are present either dissolved or suspended in the blood.

Components of Blood and their Functions

Plasma:

The liquid part of the blood is called plasma. It constitutes about 55% by volume of blood in a normal person. Plasma contains 90% water and dissolved substances 10%.

i. Plasma Proteins:

7-9% of the plasma is made of different types of proteins e.g., fibrinogen take part in blood clotting, immune globulins defend against diseases and albumin maintain osmotic pressure.

ii. Mineral Ions:

Dissolved mineral salts e.g., chlorides, bicarbonates, sodium, potassium and calcium.

iii. Metabolites and Wastes:

Metabolites are amino acids, glucose, vitamins, lipids and metabolic wastes are urea, uric acid etc.

iv. Hormones:

All the hormones present in the plasma are to be carried by the blood.

v. Dissolved Gases:

Carbon dioxide and oxygen in the plasma.

Blood cells and cell like bodies:

Blood cells form about 45% by volume of the blood. These include red blood cells, white blood cells and platelets.

a. Red Blood Cells:

These are called erythrocytes. R.B.C is a circular flattened, biconcave disc. It has no nucleus. RBC have iron-containing pigment haemoglobin in its cytoplasm, which gives red colour to the blood. RBC's are formed in bone marrow after birth. Their life span is 120 days. When they are worn-out, they are destroyed in spleen and liver. RBCs carry oxygen and also transport a small amount of carbon dioxide.

b. White Blood Cells:

White blood cells are called leukocytes. Their life span is 3-4 days. Each white blood cell is irregular in shape and contains a nucleus.

Types of White Blood Cells:

WBC's can be divided into two main types:

- i. Granular leukocytes
- ii. Agranular leukocytes

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i. **Granular Leukocytes:**

Their nucleus is variable in shape. Cytoplasm contains fine granules. These originate in bone marrow. Granular leukocytes are of three types, neutrophils, eosinophils and basophils.

- **Neutrophils:** Neutrophils engulf pathogens during phagocytosis.
- **Eosinophils:** Eosinophils are involved in the control of allergic reactions.
- **Basophils:** Basophils release histamine in injured tissue and in allergic response.

ii. **Agranular Leukocytes:**

The cytoplasm is clear. These are of two types i.e., monocytes and lymphocytes.

- **Monocytes:** These are phagocytic and ingest bacteria and dead cells at the damaged tissue region.
- **Lymphocytes:** There are two types of lymphocytes. B Lymphocytes protect us by producing antibodies. T lymphocytes directly destroy any cell that bears antigens.

c. **Platelets:**

Platelets are known as thrombocytes. Bone marrow cells called megakaryocytes form fragments called platelets. Platelets play an important role in blood clotting.

Composition of blood			
Plasma	Description	Amount in %age	Functions
	Liquid portion of blood	55% by volume	Carries blood cells and important blood proteins, hormones, salts etc.
Cell Types	Description	Average Number present	Functions
Red Blood Cells (Erythrocytes)	Like a biconcave disc; without nucleus; contain haemoglobin	5,000,000 per mm ³	Transport Oxygen and a small amount of CO ₂
White Blood Cells (Leukocytes)	Granular and agranular; contain nucleus Larger in size than RBCs	7500 per mm ³	Play role in body's defense by different ways like: Engulf small particles Release anticoagulants Produce antibodies
Platelets (Thrombocytes)	Fragments of bone marrow cells (megakaryocytes)	250,000 per mm ³	Involved in blood clotting

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Q10. Describe ABO-blood group system.

Ans: Blood Group Systems:

Blood group systems are a classification of blood based on the presence or absence of antigens on the surface of red blood cells. An **antigen** is a molecule that can stimulate an immune response (antibody production etc.).

Blood group — ABO system:

Red blood cells have antigens on their membrane. The plasma has antibodies. An antigen is a substance, which promotes the formation of antibodies. Antibody is a protein that has been formed in response to antigen. Agglutination or clumping of red blood cells occurs due to antigen - antibody reaction. According to ABO system in humans blood groups are A, B, AB, and O.

Some people were found to have antigen A, some had B, and some had both A and B and some has neither A nor B antigen. Those with A type blood do not carry the corresponding anti A antibody, but they carry anti B antibody in their plasma. B type people carry anti A but not anti B antibody, persons with AB type blood have both A and B antigens associated with red blood cells, but no anti A antibody or anti B antibody in their plasma. O type individuals have no A and B antigens but carry both anti A and anti B antibodies.

Human ABO Blood Group System				
Blood Group	Type of Antigen on RBCs	Type of antibodies in plasma	Compatible Can receive from	Can donate to
A	A	anti B	A,O	A, AB
B	B	anti A	B,O	B,AB
AB	A,B	None	A,B,AB,O	AB
O	None	anti A, anti B	O	A, B, AB, O

Q11. Write a note on:

- a. leukaemia b. thalassemia

Ans:

a. **Symptoms of leukaemia:**

The symptoms of leukaemia are fatigue, weight loss, repeated infection, anaemia, nose bleeding, bone pain etc.

Cause of leukaemia:

It is due to uncontrolled production of leukocytes. As a result, white blood cells greatly increase in the circulating blood.

Treatment of leukaemia:

Chemotherapy is the most effective method of treating leukaemia.

b. **Symptoms of thalassemia:**

The symptoms of thalassemia are severe anaemia, fatigue, bleeding gums, larger spleen etc.

Cause of thalassemia:

It is transmitted genetically due to a recessive gene.

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Thalassemia minor:

If a single recessive gene is present, this condition is called thalassemia minor.

Thalassemia major:

Two recessive genes give severe disease called thalassemia major.

Treatment of thalassemia:

The treatments of thalassemia are blood transfusion and bone marrow transplant.

Q12. Describe the external and internal structure of human heart.

Ans: Human Heart:

The human heart is a hollow pumping organ, it is somewhat conical in shape. It is about the size of a man's fist.

External structure of Human Heart:

Pericardium:

The heart is enclosed in a thin tough transparent sac, the pericardium.

Pericardial fluid:

There is a fluid between the heart and the pericardium called pericardial fluid. It is lubricating fluid, which reduces friction between the pericardium and heart.

Myocardium:

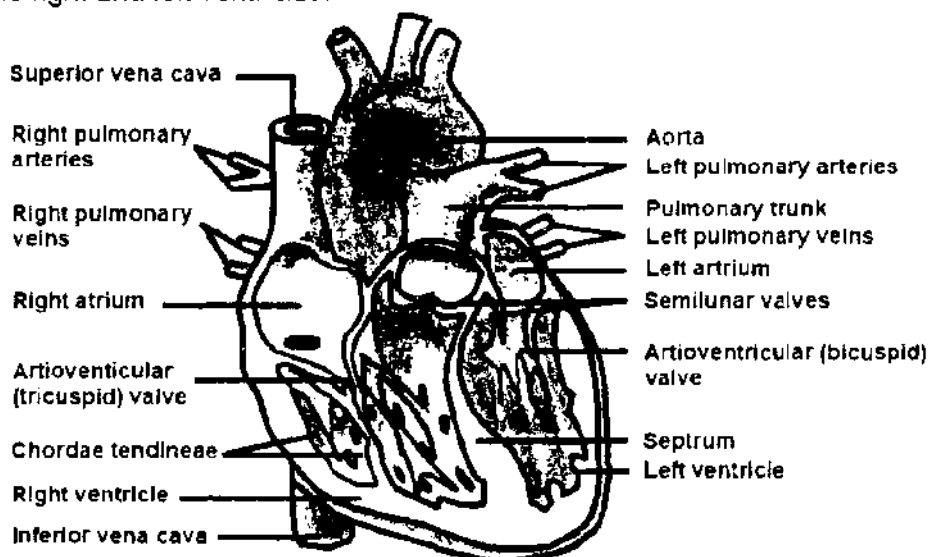
The major portion of the heart is called myocardium. It consists largely of cardiac muscle tissue.

Internal structure of Human Heart:

Internally, the heart is divided by a vertical partition into two halves, the right and left.

Septum: The vertical partition is called septum. Each half is again divided into an upper thin-walled atrium and a lower thick-walled ventricle.

Chambers of Heart: The heart consists of four chambers, the right and left atria and the right and left ventricles.



Dissection of a human heart, as seen from the front, with the ventral part of both atria and both ventricles removed.

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The atria receive blood and the ventricles distribute it. Blood from the head, neck and arms is returned to the right atrium by superior vena cava. Blood from lower parts of the body is brought back by the inferior vena cava to the right atrium.

Function of right atrium:

The right atrium receives deoxygenated blood from the two-vena cava. When the right atrium contracts, the blood flows into the right ventricle through the tricuspid valve.

Tricuspid valve:

When the right ventricle contracts the blood pressure closes tricuspid valve. This prevents back flow of blood into the atrium. The blood leaves the right ventricle by pulmonary trunk. The pulmonary trunk divides into two pulmonary arteries one to each lung.

Semilunar valves:

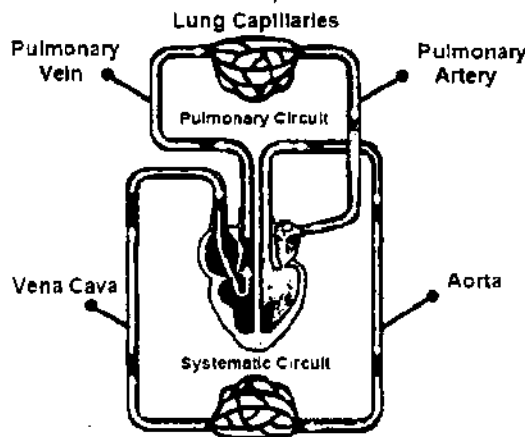
Return of blood into the ventricle is prevented by semilunar valves in the pulmonary trunk. Oxygenated blood from the lungs is brought back to the heart by way of the pulmonary veins, which open into the left atrium.

Bicuspid valve:

When the left atrium contracts the blood enters the left ventricle through bicuspid valve. When the left ventricle contracts, blood leaves by a large artery, the aorta. From the aorta blood is distributed to all parts of the body except lungs.

Semilunar valves:

Aorta also has semilunar valves to prevent back flow into the left ventricle.



Circulation of blood

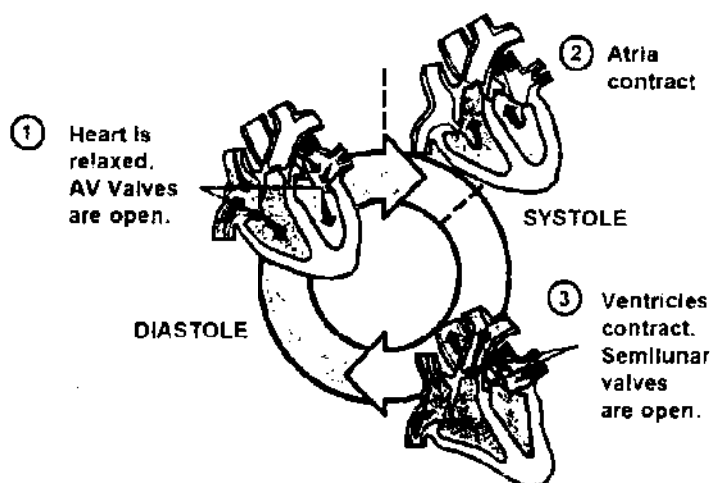
Heartbeat:

The alternating contraction and relaxation of the atria and ventricles is called cardiac cycle. The two atria contract simultaneously emptying blood into ventricles. A fraction of a second later, the two ventricles contract simultaneously, forcing blood into arteries leaving the heart. Both the ventricles then relax for less than a second before the cycle is repeated.

Systole and Diastole:

The period of contraction is called systole and the period of relaxation is called diastole. A heartbeat includes one systole and one diastole.

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Cardiac cycle

Pulse Rate:

The beating of the heart is also felt in the arteries as pulse. Pulse is the vibration felt in arterial walls due to expansion of the aorta following ventricular contraction. If you place fingers on an artery on the wrist you will feel the pulse. A normal adult pulse rate can vary from 60-100 times per minute. Normally it is 68-72. The rate of heartbeat is indicated by the pulse rate.

Q13. Write the differences between artery, vein and blood capillaries?

Ans: Comparison of arteries, veins and capillaries:

Arteries	Veins	Capillaries
Transport blood away from the heart to the various part of the body through capillaries.	Collect blood from body through capillaries and transport it towards heart	Link arteries with veins
All arteries carry oxygenated blood except pulmonary arteries	All veins carry deoxygenated blood except pulmonary veins	These have a mixed oxygenated and deoxygenated blood.
There are no valves in them except at the base of pulmonary trunk and aorta.	Valves are present only below the heart region of the body. These prevent the back flow of blood.	There are no valves
Have a high blood pressure	Have a low blood pressure	Blood pressure falls in these.
Can be detected	No pulse	No pulse.
Have smaller lumen and thick wall.	Have larger lumen with thin walls.	Narrower lumen, wall with one cell thickness.
Thick muscle layer	Thin muscle layer	No muscles.
No exchange of materials takes place	No exchange of materials takes place	Responsible for exchange materials.

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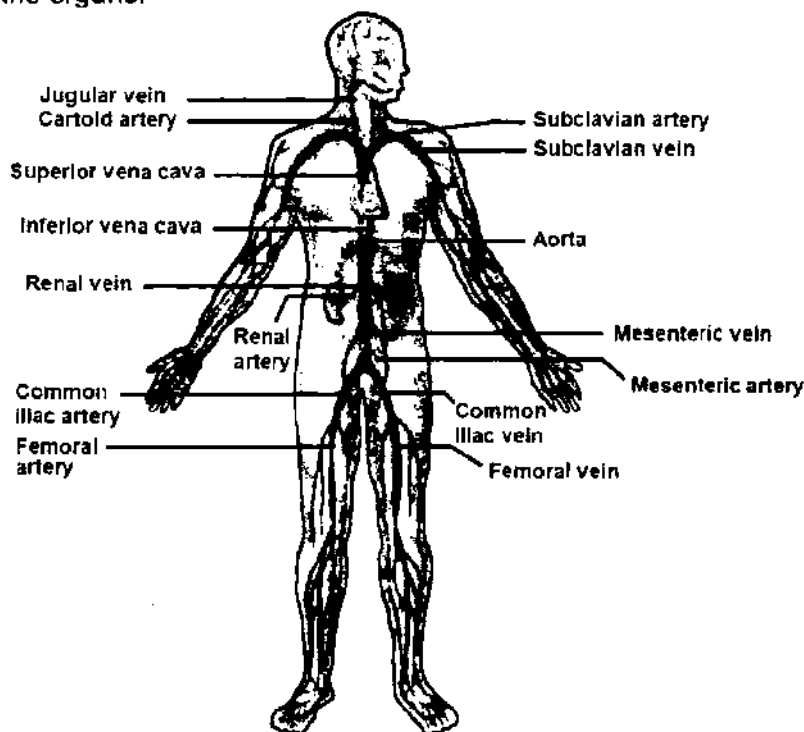
Q14. Describe pulmonary and systemic circulation?

Ans: Pulmonary Circulation:

The pulmonary circulation consists of pulmonary trunk, pulmonary arteries and pulmonary veins. Pulmonary arteries carry deoxygenated blood to the lungs. After oxygenation, pulmonary veins bring back oxygenated blood to left atrium.

Systemic circulation:

The systemic circulation includes all of the other arteries and veins, the largest artery in the systemic circuit is the aorta, which branches into arteries leading to the organs.



Artery and veins system of men

Major Arteries in Systemic circulation:

The following major arteries are:

- i. **Coronary arteries:**
Supply blood to the heart itself.
- ii. **Carotid arteries:**
Supply blood to the head and neck.
- iii. **Subclavian arteries:**
Supply blood to arms.
- iv. **Dorsal aorta:**
It curls backward and continues downwards as the dorsal aorta.
From the dorsal aorta, the following arteries are given off:
 - a. **Hepatic artery:**
Supplies blood to the liver.
 - b. **Mesenteric arteries:**
Supply blood to the intestine.

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c. Renal arteries:

Supply blood one to each kidney.

d. Common iliac arteries:

Supply blood one to each leg. This artery divides into femoral artery.

Main Veins:

Blood is returned to the heart by the main veins as follows:

i. Jugular veins:

Bring blood from head and neck.

ii. Subclavian veins:

Bring blood from the forelimbs.

iii. Superior vena cava:

Jugular and subclavian veins unite to form the superior vena cava which opens into the right atrium of the heart.

iv. Common iliac veins:

Common iliac veins and femoral vein brings blood from the lower limbs.

v. Renal veins:

Bring blood from the kidneys.

vi. Hepatic veins:

Bring blood from liver and digestive system

vii. Inferior vena cava:

Iliac, renal and hepatic veins join to form inferior vena cava. It opens into the right atrium of the heart.

Hepatic Portal Vein:

The veins from the digestive system do not open directly into the inferior vena cava. They unite to form the hepatic portal vein. It enters the liver and breaks up into many capillaries. The capillaries join to form hepatic vein. A portal vein is so called because it carries blood from one capillary network to another.

Q15. Define cardio-vascular disorders. Discuss arteriosclerosis and myocardial infarction.

Ans: Cardiovascular Disorders:

The disorders of the heart and blood vessels (arteries and veins) is called cardiovascular disorders. Cardiovascular disorders are the leading cause of untimely death in man.

Atherosclerosis and Arteriosclerosis:

Arteriosclerosis is hardening of the arteries. Atherosclerosis is the deposition of materials in the arteries. The deposits of cholesterol are called plaques which increase in size and begin to block arteries.

Plaques can cause a clot to form on the irregular arterial wall. As long as the clot remains stationary, it is called a thrombus. If the clots breakaway, it may block artery at another location.

Embolus: The dislodged dot moving along with the blood is called an embolus.

Haemorrhage: Hardened arteries lose their elasticity. It may rupture, a process known as haemorrhage.

Myocardial Infarction (heart attack):

The term myocardial infarction is derived from myocardium (the heart muscle) and infarction (tissue death). It is more commonly known as a heart attack.

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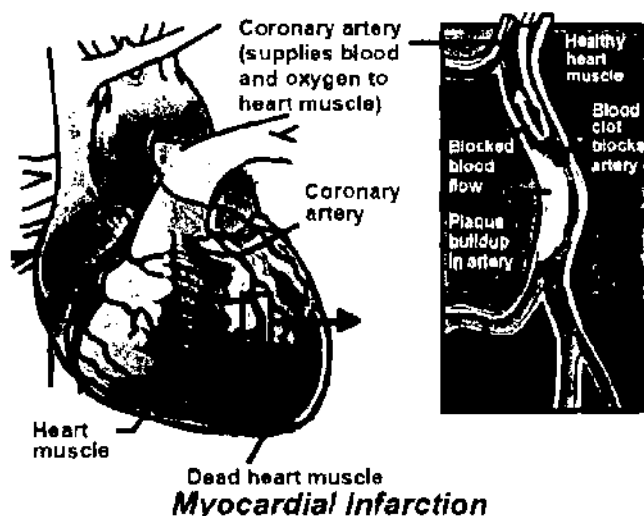
It occurs when blood supply to a part of heart is interrupted and leads the death of heart muscles.

Causes of Myocardial Infarction (heart attack):

Heart attack may be caused by blood clot in coronary arteries. It is a medical emergency, and the leading cause of death for both men and women all over the world

Symptoms of Myocardial Infarction (heart attack):

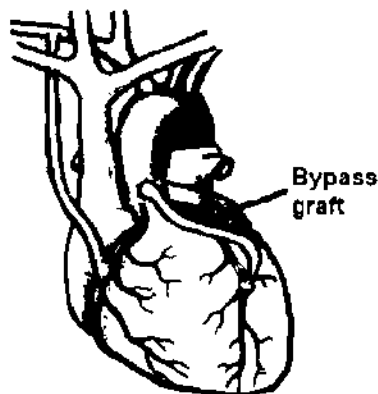
Severe chest pain is the most common symptom of myocardial infarction and may be in the form of sensation of tightness, pressure, or squeezing. Pain radiates most often to left arm, but may also radiate to lower jaw, neck, right arm and back. Loss of consciousness and even sudden death can occur in myocardial infarction.



Myocardial Infarction

Treatment:

- Medical treatment includes the use of an enzyme that dissolves blood clot.
- Coronary bypass surgery is done to treat blocked arteries. In this surgery blood vessel from elsewhere in the patient body are grafted to coronary arteries to improve blood supply to heart muscles.
- Angioplasty is the mechanical widening of a narrow or totally blocked coronary artery.



Coronary artery bypass graft operation

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Preventions:

- i. Avoid food rich in salt and fats.
- ii. Maintain healthy body weight.
- iii. Control blood pressure.
- iv. Regular walk and exercise
- v. Avoid smoking.
- vi. Avoid stress.

THE TERMS TO KNOW

1. **ABO system:** The blood group system based on the presence or absence of antigen A and B.
2. **Agglutination:** Agglutination is the clumping of particles. It is a process that occurs if an antigen is mixed with its corresponding antibody called isoagglutinin. This term is commonly used in blood grouping.
3. **Agranulocyte:** The leukocytes with clear cytoplasm.
4. **Albumin:** Proteins present in blood plasma; maintain the water balance of blood.
5. **Angina pectoris:** The pain that tells that the blood supply to the cardiac muscles is not sufficient but the shortage is not enough to cause tissue death.
6. **Anti-A antibody:** The antibody present in the blood groups where A antigens are absent i.e. blood groups B and O.
7. **Anti-B antibody:** The antibody present in the blood groups where B antigens are absent i.e. blood groups A and O.
8. **Antigen:** A molecule that can stimulate an immune response in the body.
9. **Antigen A:** The antigen present on the surface of RBCs in people with blood group and AB.
10. **Antigen B:** The antigen present on the surface of RBCs in people with blood group B and AB.
11. **Anti-Rh antibody:** The antibody produced in people with Rh-negative blood group when they encounter Rh antigens of Rh-positive blood.
12. **Aorta:** The main artery that carries oxygenated blood from left ventricle.
13. **Aortic arch:** An arch formed when the aorta curves left.
14. **Arteriole:** The smaller vessels formed by the division of arteries in organs.
15. **Arteriosclerosis:** The hardening of the arteries.
16. **Artery:** The blood vessels that carry blood from heart to body parts.
17. **Atherosclerosis:** The narrowing of arteries due to accumulation of fatty material, cholesterol or fibrin.
18. **Atrial systole:** The period of cardiac cycle in which the atria contract.
19. **Atrium:** Right and Left Atria: The upper thin-walled chambers of the heart.
20. **B lymphocyte:** The lymphocytes that synthesize antibodies after recognizing the antigens.
21. **Basophils:** The type of granulocytes; responsible for inflammation.

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- 22. **Bicuspid valve:** The valve present at the opening between the left atrium and left ventricle.
 - 23. **Blood group system:** The classification systems of the blood types on the basis of the presence or absence of specific antigens on RBCs.
 - 24. **Cohesion-tension theory:** The theory which states that the force which carries water (along with dissolved salts) upward through the xylem is the transpirational pull.
 - 25. **Coronary artery:** The artery that supplies blood to the heart muscles.
 - 26. **Cortex:** The cortex is bounded on the outside by a single layer of epidermal cells.
 - 27. **Diastole:** Diastole is the period of time when the heart fills with blood after systole (contraction).
 - 28. **Dorsal aorta:** The aorta after aortic arch.
 - 29. **Embolus:** The dislodged and free-floating thrombus.
 - 30. **Endodermis:** The endodermis is the central, innermost layer of cortex in land plants. It is a cylinder of compact living cells, the radial walls of which are impregnated with hydrophobic substances to restrict apoplastic flow of water to the inside. The endodermis is the boundary between the cortex and the stele.
 - 31. **Eosinophil:** Type of granulocytes; with bilobed nucleus.
 - 32. **Erythrocyte:** Red blood cell.
 - 33. **Fibrin:** The insoluble thread-like protein formed from the conversion of fibrinogen.
 - 34. **Fibrinogen:** The blood clotting protein present in blood plasma.
 - 35. **Granulocytes:** Type of leukocytes with granular cytoplasm.
 - 36. **Guard cell:** The bean-shaped cell; Two guard cells are present around a stoma.
 - 37. **Haemoglobin:** The red pigment present in RBC; responsible for the transport of oxygen and small amounts of carbon dioxide.
 - 38. **Heart rate:** The number of times the heart beats per minute.
 - 39. **Lenticel:** Small opening present in some stems.
 - 40. **Leucocyte:** White blood cells (WBCs), also called leukocytes or leucocytes, are the cells of the immune system that are involved in protecting the body against both infectious disease and foreign invaders.
 - 41. **Leukaemia:** The production of great number of immature and abnormal leukocytes.
 - 42. **Lymphocytes:** Lymphocytes are the major component of the immune system. They are 32% of leukocytes.
 - 43. **Lymphogenous cells:** Lymphogenous cells are a group of leukemias affecting circulating lymphocytes, a type of white blood cells.
 - 44. **Megakaryocyte:** Bone marrow cell.
 - 45. **Monocyte:** A type of agranulocytes; becomes macrophage after entering an inflamed tissue.
 - 46. **Myocardial Infarction:** The death of heart tissue.

BIOLOGY NOTES FOR 9TH CLASS

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- 47. **Neutrophil:** Type of granulocytes; destroys small particles by phagocytosis.
 - 48. **Pericardial fluid:** Pericardial fluid is the serous fluid secreted by the serous layer of the pericardium into the pericardial cavity. The pericardium consists of two layers, an outer fibrous layer and the inner serous layer
 - 49. **Pericardium:** Sac of membranes enclosing the heart.
 - 50. **Pericycle:** The pericycle is a cylinder of parenchyma or sclerenchyma cells that lies just inside the endodermis and is the outer most part of the stele of plants.
 - 51. **Phloem:** The complex tissue in plants; responsible for the transport of food.
 - 52. **Plasma:** The liquid portion of blood.
 - 53. **Platelet:** The cell-like bodies in blood; responsible for blood clotting.
 - 54. **Pulmonary artery:** The *pulmonary artery* carries deoxygenated blood from the right ventricle to the lungs .
 - 55. **Pulmonary circulation:** The pathway on which deoxygenated blood is carried from heart to the lungs and in return oxygenated blood is carried from the lungs to heart.
 - 56. **Pulmonary veins:** The pulmonary veins are the veins that transfer oxygenated blood from the lungs to the heart. The largest pulmonary veins are the four main pulmonary veins, two from each lung that drain into the left atrium of the heart. The pulmonary veins are part of the pulmonary circulation.
 - 57. **Pulse:** The rhythmic expansion and contraction of an artery as blood is forced through it by the regular contractions of the heart.
 - 58. **Red Blood Cells:** Red blood cells, also referred to as red cells, red blood corpuscles, haematids, erythroid cells or erythrocytes, are the most common type of blood cell and the vertebrate's principal means of delivering oxygen to the body tissues—via blood flow through the circulatory system.
 - 59. **Rh factors:** The antigen present on the RBCs in people with Rh-positive blood group.
 - 60. **Rh blood group system:** The blood group system based on the presence or absence of Rh-Factors.
 - 61. **Root hair:** The cytoplasmic extension of root epidermis cells
 - 62. **Semilunar valves:** The valve present at the base of pulmonary trunk and at the base of aorta
 - 63. **Stoma:** The small opening present in the epidermis of leaves.
 - 64. **Systemic circulation:** The pathway on which oxygenated blood is carried from the heart to the body tissues and in return deoxygenated blood is carried from the body tissues to the heart.
 - 65. **T lymphocyte:** The type of lymphocyte that recognizes the antigens and kills them.
 - 66. **Thalassaemia:** The blood disease in which the haemoglobin does not has beta-chain.
 - 67. **Thrombocytes:** Thrombocytes also called platelets. Thrombocytes are a component of blood whose function (along with the coagulation factors) is to stop bleeding by clumping and clotting blood vessel injuries.

BIOLOGY NOTES FOR 9TH CLASS

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- 68. **Thrombus:** The blood clots in arteries formed by plaques of different material e.g. cholesterol.
 - 69. **Transpiration:** The loss of water from plant surface through evaporation.
 - 70. **Transpirational pull:** The pulling force for water and salts; created by transpiration.
 - 71. **Tricuspid valve:** The valve present at the opening between the right atrium and right ventricle.
 - 72. **Vein:** The blood vessel that carries blood from body parts to heart.
 - 73. **Vena cava:** The major veins entering the right atrium.
 - 74. **Ventricle:** The lower thick-walled chambers of the heart.
 - 75. **Ventricular systole:** The contraction of heart ventricles.
 - 76. **Venule:** The smaller veins in organs formed by the joining of capillaries.
 - 77. **White Blood Cells:** White blood cells are colourless, as they do not contain pigments. They are not confined to blood stream, as they also migrate out into the tissue fluid.
 - 78. **Wilting:** Wilting is the loss of rigidity of non-woody parts of plants. This occurs when the turgor pressure in non-lignified plant cells falls towards zero, as a result of diminished water in the cells.
 - 79. **Xylem:** The complex tissue in plants; responsible for the transport of water and salts.

MULTIPLE CHOICE QUESTIONS

- 1. **In most plants the food is transported in the form of;**
 - A. Glucose
 - B. Sucrose
 - C. Starch
 - D. Proteins
- 2. **Stomata close when the guard cells;**
 - A. Lose water
 - B. Gain chloride ions
 - C. Become turgid
 - D. Gain potassium ions
- 3. **Trace the pathway of water from the soil through the plant to the atmosphere.**
 - A. Endodermis, cortex, epidermis, vessel elements, intercellular spaces in mesophyll, stomata
 - B. Epidermis, endodermis, phloem, cortex of leaf, intercellular spaces of mesophyll, stomata
 - C. Root hairs, epidermis, cortex, xylem, endodermis, intercellular spaces in mesophyll, stomata
 - D. Root hairs, cortex, endodermis, vessel elements, intercellular spaces in mesophyll, stomata
- 4. **When fibrinogen makes blood clot it separates from blood and the remainder is called;**
 - A. Plasma
 - B. Lymph
 - C. Serum
 - D. Puss

BIOLOGY NOTES FOR 9TH CLASS

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5. **What is correct about human red blood cells?**
A. Have limited life span
B. Are capable of phagocytosis
C. Produce antibodies
D. Are multinucleate
6. **Which of the following tissue layer is found in all blood vessels?**
A. Smooth muscle
B. Endothelium
C. Skeletal muscle
D. Connective tissue
7. **When do the atria contract?**
A. Before diastole
B. After systole
C. During diastole
D. During systole
8. **Which of the following contains deoxygenated blood in an adult human?**
A. Left atrium
B. Pulmonary artery
C. Pulmonary vein
D. All of the above
9. **Which of the following chambers has the thickest walls in human heart?**
A. Right atrium
B. Left atrium
C. Left ventricle
D. Right ventricle
10. **Which of these statements is correct about the circulatory system?**
A. It transports hormones
B. Capillaries have thicker walls than veins
C. Systemic circulation carries blood to and from the lungs
D. All are true
11. **The exchange of materials between the blood and the surrounding tissues occurs in;**
A. Arteries
B. Veins
C. Capillaries
D. All of these
12. **Which of the following is a type of leukocyte?**
A. Macrophage
B. Eosinophil
C. Monocyte
D. All of the above
13. **Which of the following is a function of human blood?**
A. It regulates body temperature
B. It transports wastes
C. It provides defence
D. All of the above
14. **Valves to prevent the backflow of blood are found in the;**
A. Arteries
B. Veins
C. Capillaries
D. All of the above
15. **Plasma is made up of water and _____,**
A. Metabolites and wastes
B. Salts and ions
C. Proteins
D. All of the above
16. **Which cells of blood are responsible for clotting?**
A. Platelets
B. Erythrocytes
C. Neutrophils
D. Basophils

BIOLOGY NOTES FOR 9TH CLASS

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- 17. Find the correct path of blood circulation?**
 A. Left atrium, left ventricle, lungs, right atrium, right ventricle, body
 B. Right atrium, right ventricle, lungs, left atrium, left ventricle, body
 C. Left atrium, left ventricle, right atrium, right ventricle, lungs, body
 D. Right atrium, lungs, right ventricle, left atrium, body, left ventricle
- 18. A patient with blood group A can be given the blood of donor who has:**
 A. Blood group A or AB
 B. Blood group A or O
 C. Blood group A only
 D. Blood group O only
- 19. The death of the heart tissue is called;**
 A. Atherosclerosis
 B. Arteriosclerosis
 C. Myocardial infarction
 D. Thalassemia
- 20. What happens when a mismatched blood group is injected in recipient?**
 A. Antibodies of the recipient's blood destroy donor's RBCs
 B. Antibodies of the donor's blood breakdown recipient's RBCs
 C. Both of these can happen
 D. None of these happens and such transfusion can be safe

ANSWERS:

1. B	2. A	3. D	4. C	5. A
6. B	7. D	8. B	9. C	10. A
11. C	12. D	13. D	14. B	15. D
16. A	17. B	18. B	19. C	20. C

MULTIPLE CHOICE QUESTIONS

- 1. The antigen present on the surface of RBCs in people with blood group and AB**
 A. Antigen A
 B. Antigen B
 C. Anti-B antibody
 D. Antigen
- 2. The antigen present on the surface of RBCs in people with blood group B and AB**
 A. Antigen
 B. Antigen A
 C. Antigen B
 D. Anti Rh antibody
- 3. The antibody produced in people with Rh-negative blood group when they encounter Rh antigens of Rh-positive blood**
 A. Antigen
 B. Antigen A
 C. Antigen B
 D. Anti-Rh antibody
- 4. The main artery that carries oxygenated blood from left ventricle**
 A. Aorta
 B. Aortic arch
 C. Arteriole
 D. Basophils

BIOLOGY NOTES FOR 9TH CLASS

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5. **An arch formed when the aorta curves left**

A. Aortic arch	B. Aortic arch
C. Arteriole	D. Arteriosclerosis
 6. **The pathway in plants through which water travels along cell walls and through intercellular spaces to reach the core of the root**

A. Aortic arch	B. Arteriole
C. Apoplast pathway	D. Basophils
 7. **The smaller vessels formed by the division of arteries in organs**

A. Arteries	B. Right ventricle
C. Left ventricle	D. Arteriole
 8. **The hardening of the arteries**

A. Arteries	B. Veins
C. Arteriosclerosis	D. Capillaries
 9. **The blood vessels that carry blood from heart to body parts**

A. Veins	B. Capillaries
C. Arteriole	D. Artery
 10. **The narrowing of arteries due to accumulation of fatty material, cholesterol or fibrin**

A. Antigen	B. Atherosclerosis
C. Erythrocytes	D. Neutrophils
 11. **The period of cardiac cycle in which the atria contract**

A. Arteriosclerosis	B. Aortic arch
C. Atrial systole	D. Arteriole
 12. **The upper thin-walled chambers of the heart**

A. Atrium	B. Aorta
C. Arteriole	D. Basophils
 13. **The lymphocytes that synthesize antibodies after recognizing the antigens**

A. Antigen	B. Erythrocytes
C. Neutrophils	D. Lymphocyte
 14. **The type of granulocytes; responsible for inflammation**

A. Basophils	B. Neutrophils
C. Erythrocytes	D. Lymphocyte
 15. **The valve present at the opening between the left atrium and left ventricle**

A. Coronary valve	B. Pulmonary valve
C. Bicuspid valve	D. Semilunar valve
 16. **The complex tissue in plants; responsible for the transport of water and salts**

A. Phloem	B. Xylem
C. Stoma	D. Guard cell
 17. **The blood vessels formed by the division of smaller arteries; Unite to form smaller veins**

A. Arteries	B. Veins
C. Capillary	D. Aorta

BIOLOGY NOTES FOR 9TH CLASS

18. The smaller veins in organs formed by the joining of capillaries
A. Arteries
B. Veins
C. Venule
D. Arteriole
19. The blood vessel that carries blood from body parts to heart
A. Vein
B. Arteriole
C. Capillaries
D. Arteries
20. The theory which states that the force which carries water (along with dissolved salts) upward through the xylem is the transpirational pull
A. Transpiration theory
B. Cohesion theory
C. Turgor theory
D. Cohesion-tension theory
21. The artery that supplies blood to the heart muscles
A. Pulmonary artery
B. Cardiac artery
C. Coronary artery
D. Semi-lunar artery
22. The insoluble thread-like protein formed from the conversion of fibrinogen
A. Fibrin
B. Erythrocytes
C. Basophils
D. Neutrophils
23. The blood clotting protein present in blood plasma
A. Lymphocyte
B. Fibrinogen
C. Fibrin
D. Basophils
24. Type of leukocytes with granular cytoplasm
A. Granulocyte
B. Lymphocyte
C. Fibrinogen
D. Erythrocytes
25. The production of great number of immature and abnormal leukocytes
A. Anemia
B. Leukaemia
C. Thalassemia
D. Arteriosclerosis
26. A type of agranulocytes; becomes macrophage after entering an inflamed tissue
A. Neutrophils
B. Lymphocyte
C. Monocyte
D. Basophils
27. Type of granulocytes; destroys small particles by phagocytosis
A. Basophils
B. Neutrophil
C. Lymphocyte
D. Erythrocytes
28. The complex tissue in plants; responsible for the transport of food
A. Xylem
B. Stoma
C. Phloem
D. Guard Cell
29. The liquid portion of blood
A. Platelet
B. WBCs
C. RBCs
D. Plasma
30. The cell-like bodies in blood; responsible for blood clotting
A. Platelet
B. Plasma
C. RBC
D. WBC
31. The protein in blood plasma; acts as catalyst in blood clotting
A. Fibrin
B. Fibrinogen
C. Basophils
D. Prothrombin

BIOLOGY NOTES FOR 9TH CLASS

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32. The blood disease in which the haemoglobin does not has beta-chain
 A. Anemia B. Leukaemia
 C. Thalassaemia D. Arteriosclerosis
33. The pain that tells that the blood supply to the cardiac muscles is not sufficient but the shortage is not enough to cause tissue death
 A. Angina pectoris B. Antigen
 C. Cardiac Cycle D. Fibrin
34. The antibody present in the blood groups where A antigens are absent i.e. blood groups B and O
 A. Antigen B. Anti-A antibody
 C. Anti-B antibody D. Antigen A
35. The antibody present in the blood groups where B antigens are absent i.e. blood groups A and O
 A. Anti-A antibody B. Antigen
 C. Anti-B antibody D. Antigen A
36. A molecule that can stimulate an immune response in the body
 A. Antigen A B. Antigen B
 C. Anti Rh antibody D. Antigen

ANSWERS:

1. A	2. C	3. D	4. A	5. B	6. C
7. D	8. C	9. D	10. B	11. C	12. A
13. D	14. A	15. C	16. B	17. C	18. C
19. A	20. D	21. C	22. A	23. B	24. A
25. B	26. C	27. B	28. C	29. D	30. A
31. D	32. C	33. A	34. B	35. C	36. D